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(54) **Method and apparatus for finding and selecting a desired data item from a large schedule of data items using a TV set and a controller similar to a TV-remote-control**

(57) An apparatus and method for presenting a viewer with an overall representation of the present number of entertainment programs available for selection given one week of program schedule data for 300 or more channels and one or more filtering criteria to limit the number of items represented in the overall representation. Sequentially applied filters will filter the group of program schedule data items that has at least 100,000 half hour time slots offered by 300 channels each week into a smaller subgroup where individual

consideration of each item of the subgroup can be made in a reasonable time. A set top box drives the display of overall representations or results of filtering criteria on a commercial TV set. Once a reasonable sized subgroup is obtained, other displays provide specific information of the program offerings of the subgroup. Selection of the filtering criteria and selection from within a subgroup is interactively made by a viewer through the use of a controller that looks and operates very much like a TV remote control. This makes the interaction familiar, easy and predictable.

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**Description****Technical Field**

5        The invention concerns a method and apparatus for subjecting a large schedule of data items having multiple attributes to consecutive selection criteria in order to reduce the number of individual programs to a manageable group which can be visually searched for a desired data item having a selected subset of the attributes, and more particularly to an apparatus and method which use an interactive control having directional buttons and a select button that are used in conjunction with an interactive display viewed on a normal television set to select the desired data item.

**Description of the Prior Art**

10      Presently there are known methods for reducing a large quantity of data into a manageable set of data which can be visually searched for a desired item by a decision maker. One example of such a large quantity of data is a directory of a fixed drive of a computer system. Methods implemented through interactive graphical user interfaces for personal computers and workstations display and reduce disk drive directories to root directory displays which typically show root level files and one or more branch subdirectories for the user's selection. Upon selection of a subdirectory, usually by a mouse, the display typically shifts showing files of the selected subdirectory and sub-subdirectories for further selection. The subdirectory display is often too big to fit on the screen, so interactive scroll bars are typically provided 15     so the display may be controlled by a mouse. Using the mouse and the scroll bars, a user may work down the directory tree structure until the desired file is found. Such graphical user interfaces are common for computers and monitors where visual definition is typically at least 640 x 480 pixels for each display. Such techniques might be used in homes to access databases of useful information, such as airline schedules, television programming schedules and movie-on-demand catalogues. Unfortunately, each home does not have a computer or work station with 640x480 pixel definition 20     which could take advantage of such existing databases. Further, the NTSC television set which almost every home has in its living room has relatively low viewing definition compared to 640 x 480 pixels or more per screen definition of computer monitors. Moreover, the typical home television set is not connected to a mouse, which is not an appropriate pointing device for the living room, rather most television sets have controls on control panels and/or 25     on a remote controls. If just a fraction of these home television sets were used to find and select airline ticket reservations, programs to watch on 300 hundred or more channel cable television services, or pay-per-view movies from a vast collection, the profitability of the service providers and the satisfaction of the users would both be improved. The 30     300 plus channels mentioned, may use any type of transmission scheme that will deliver information via a cable or wireless path and includes but is not limited to time division multiplexed channels, frequency division multiplexed channels and packet data multiplexed channels.

35      One known approach for the TV programming schedule is to display the presently showing programs along with the next subsequent programs for the next hour or so, on what is referred to as a preview channel. Because this is more information than can be legibly displayed on one television screen at once, the preview channel display often scrolls through all the channel offering for the present time and the near future. For a sixty channel system, one complete scrolling takes about three minutes. At such a rate, a one hundred channel cable service would take five minutes and the future three hundred plus channel cable services would take 15 minutes. Needless to say, three minutes is a long 40     time, but acceptable because breaks between programs are about that long. Five and fifteen minutes time periods though represent a substantial portion of a 30 minute program and are simply too long to expect a TV viewer to wait. The alternatives of speeding up the scrolling rate or using smaller size letters for descriptions are not practical either 45     because either of these actions reduces the ability of the viewer to read and understand the schedule. Thus, there is a need in the art for a method and apparatus that allows a viewer to quickly find and select a desired data item from a large schedule, in this case a TV program for viewing from a TV programming schedule for 300 plus channels over the ensuing hours or even days. There is a similar need for a method and apparatus, very similar to the TV program selector, for finding and selecting a movie to order from movies-on-demand, or an airline flight(s) for a trip. It would further be desirable to use a method similar to the TV program selector to find and select a file in storage assets 50     accessible by the apparatus to be executed, updated or deleted as part of file maintenance.

55      It is an object of the present invention to provide a view of a large schedule of data items and interactive selections of subgroups of the large schedule of data items in order to arrive at a screen display with sufficiently small number of items and sufficiently legible descriptions of each item to provide a viewer with an opportunity to make a reasoned selection therefrom.

It is another object of this invention to provide a method for interactively selecting a data item from a large schedule of data items by means of sequentially applying different filtering criteria using an interactive control having an operation appropriate for use with a television set.

Summary of the Invention

In another aspect of the invention, the aforementioned objects may be achieved by providing a method for a home television viewer to interactively select a data item from a large schedule of data item having multiple attributes. The method includes a step of receiving the large schedule of data items. The received schedule of data items is stored locally in a database format in order to expedite later filtering and retrieval. Next, the schedule of data items is filtered into a subgroup of the schedule of data items according to attributes selected by the interactive viewer inputs. The resulting subgroup of the schedule data items is displayed for the viewer's inspection. The user then interactively selects a data item from the subgroup of data items viewed on a television screen.

Briefly stated, in accordance with one aspect of the invention, the aforementioned objects are achieved by providing an apparatus for selecting an item from a large group in a system having display means and interactive movable pointing means for specifying a location in the display means and making a selection at a specified location. This apparatus includes a filtration means including subgroup specifiers in the display means and is responsive to selection of a subgroup specifier by the pointing means for filtering the list to produce the subgroup specified by the selected subgroup specifier; means for displaying representations of group items belonging to at least a portion of the subgroup in the display means; and group item selection means for selecting a group item by selecting the representation thereof in the display in response to the pointing means.

In yet another aspect of the invention, the aforementioned objects may be achieved by providing a method for a viewer to interactively select a program. The method includes a step of receiving program schedule data for at least 300 individual channels for a time period of at least a week. The received program schedule data is stored locally in a database format in order to expedite later sorting and retrieval. Next, the program schedule data is filtered into a subgroup of the program schedule data in response to interactive viewer inputs. The subgroup of the program schedule data is displayed for the viewer's inspection. The user then interactively selects a program from the subgroup of program schedule data for viewing on a TV screen, or alternatively for recording by an appropriate program recording device.

Brief Description of the Drawing

FIG. 1 is a pictorial of a television set connected through a set top box to a cable carrying the program to be selected and a controller for selecting that program.

FIG. 2 is a simplified block diagram of the set top box.

FIG. 3 is a pictorial of a controller as shown in FIG. 1.

FIG. 4 is a pictorial of a top most selection interactive display.

FIG. 5 is a pictorial of a second level selection interactive display.

FIG. 6 is a pictorial of a third level selection interactive display.

FIG. 7 is a pictorial of a first level selection query display.

FIG. 8 is a pictorial of a second level selection query display.

FIG. 9 is a pictorial of another third level selection query display.

FIG. 10 is a pictorial of a display showing a subgroup of programs meeting the Sports, All and On Now sorting criteria.

FIG. 11 is a pictorial of a display showing the subgroup of programs meeting the Sports, All and On Now sorting criteria along with a window having a preview of the highlighted program.

FIG. 12 is a pictorial of a display showing a second level selection interaction display, similar to FIG. 5.

FIG. 13 is a pictorial of a two-dimensional interactive grid display with very many program data items shown in reduced representations.

FIG. 14 is a pictorial of a third level selection query display, similar to FIG. 9.

FIG. 15 is a pictorial of a two-dimensional interactive grid display filtered down to a manageable number of data items.

FIG. 16 is a pictorial of a first alphanumeric interactive display.

FIG. 17 is the same display as FIG. 14 except that the highlighted interactive area is at a different location.

FIG. 18 is a pictorial of a second alphanumeric interactive display.

FIG. 19 is the same display as FIG. 16 except the highlighted interactive area is at a different location.

FIG. 20 is a pictorial of a third alphanumeric interactive display.

FIG. 21 is the same as FIG. 18 except that the highlighted interactive area is at a different location.

FIG. 22 is a pictorial of a fourth alphanumeric interactive display.

FIG. 23 is a pictorial of a two dimensional interactive display with logical third dimensional stacks for row and column intersections having multiple entries therein.

Detailed Description

Referring now to FIG. 1, a television set (TV) 10 is connected to set top box (STB) 12 via interconnecting cable 14. STB 12 is also connected to cable 16 which carries at least one cable program. The TV 10 is any standard TV such as an NTSC, a high definition, or some other standard commercial type for home use. A controller 20 is linked to STB 12, preferably via a free space optical link 22 for controlling the operation of STB 12 in order to select a program for viewing.

Referring now to FIG. 2, STB 12 will be described in greater detail. The STB 12 has a cable interface 30 that selects and converts the incoming signals on cable 16, whether they are digital signals, analog signals, or packet signals, to signals that are compatible with the TV 10. The cable interface 30 is connected by bi-directional bus 32 to CPU 34. Bi-directional bus 32 carries digital information received over cable 16 for use by CPU 34 and digital information transmitted from CPU 34 to cable interface 30. If cable 16 is a bi-directional cable, some of the information from CPU 34 will be processed through cable interface 30 to cable 16.

In addition to bi-directional bus 32, CPU 34 is connected to ROM 38 and RAM 40 via a memory bus 36. ROM 38 contains an operating program that is executed by CPU 34 to provide most of the functionality of the STB 12. RAM 40, among other things, provides storage space for intermediate results of the operating program as executed by CPU 34. RAM 40 provides storage for data that is received from cable 16 and filtered in response to the operating program and viewer inputs from controller 20 (shown in FIG. 1). If further storage is needed for data, larger RAM devices and/or mass storage devices such as disk drives, may be also connected bi-directional bus 32 (not shown). To receive viewer input, CPU 34 is connected to controller interface 44 via bus 42, and to provide feedback to the viewer, CPU 34 is connected to and drives STB display 48 via bus 46 with channel related information.

FIG. 3 illustrates a preferred embodiment of the controller 20. Controller 20 is designed to look and operate like a standard remote control of a TV or a video cassette recorder (VCR). Controller 20 has a numeric keypad 50 having number keys 0-9. Controller 20 has an up arrow 52, a down arrow 54, a right pointing arrow 56, a left pointing arrow 58, a double up arrow 60 and a double down arrow 62. Controller 20 also has a **select** (✓) button 64, a cancel (X) button 66 and a query (?) button 68. All interactions with the interface provided by the present invention are controlled by various sequences of these 19 buttons of the controller 20. Further, the result of actuating one of these buttons will be similar the results of a similar action of a standard TV or VCR remote control, so its use will be familiar, predictable and intuitive to the viewer using it.

There are two broad classes of graphical components used in the interface of the present invention: those used by the viewer to select a desired data view or to apply a filter to the information being displayed, such as FIG. 4; and those components used to actually display the information through which the viewer will progress in order to make a selection of a specific item, such as FIG. 6. For example, the viewer might view the schedule of TV programs for the next few hours (all channels), and filter the display to show only sports, basketball games in particular. These choices fall into the first class. Once the display of all basketball shows for the next few hours has been selected, the viewer may progress through it reviewing a text or video digest of each program as selected by the controller 20. Selection of a specific program would typically lead to an action such as videotaping the show or setting an alarm to remind the viewer that the desired program is coming up. The navigation and selection sequences to find and select the desired program are examples of the use of the second class of graphical components.

Note, that in both cases the viewer is required to navigate through multiple graphic displays in order to ultimately select a desired program. The interfaces are kept conceptually and visually distinct in the interface according to the present invention because they serve different purposes and the viewer is reminded of this by their appearance. In addition, the information involved in the view selection components, i.e., the first class, falls naturally into the form of hierarchical menus: short lists with complex substructure. In contrast, the data display, i.e., the second class, components must be able to handle large schedules and arrays of information, which are essentially flat data with simple substructure.

Additionally, there is a display component in most displays referred to as a 'frame', which functions as a status display. The frame is used to give the viewer some context (what view am I displaying?), as well as a brief summary of the presently selected item's characteristics (what item do I currently have selected?). Typically the latter would be the item's full name and useful information such as program start and stop times. The frame will be described further, later.

Referring now to FIGs. 3 and 4, a top or beginning level display 400 of the viewer interface for use with controller 20 as it appears on the viewer's TV 10 (shown in FIG. 1) during normal operation. It is depicted as a file card menu 402 having a tab labeled "Begin". On file card menu 402 are interactive buttons labeled **Movies (on Demand)** 404, **Last Movie** 406, **Options** 408, **TV** 410, **TV Now** 412, **Last TV** 414, **Shopping** 416, and **Last Shop** 418 which when selected by means of the controller 20 cause the next relevant display to be shown along with some sorting and/or filtering to be performed on the data stored in RAM 40 (shown in FIG 2). When the file card menu 402 first appears, an active area, where a selection may be made, is highlighted. This active area may be moved by actuating the arrow

buttons 52-56 and double arrow buttons 60, 62 of controller 20. The file card menu 402 is surrounded by a frame 420, the top of which indicates the designation of the active area currently highlighted. Once an active area has been highlighted, a selection is made by actuating the **select (✓)** button 64 in FIG. 4, the **TV** button 410 is shown to be active; by actuating the **select (✓)** button 64, the next display 500 shown in FIG. 5 appears. This appearance is a logical overlaying of the display 500 over the display 400. Although display 400 is not visible while any logically overlaying display is appearing on the screen of the TV 10, display 400 will become visible again if all of the logically overlaying displays are canceled, i.e. by actuating the cancel (X) button 66. Thus, until a program is selected for real time viewing, it is possible for the viewer to work his or her way back to the display 400 by actuating the cancel (X) button the appropriate number of times.

FIG. 5 shows a second level display 500 which is depicted as a file card menu 502 labeled "TV", which appears to overlay and occlude all of file card menu 402 except for the label "Begin". The label TV indicates that the items that can be accessed are TV shows, such as dramatic series, situation comedies, serials, regular variety shows, game shows, sports, and so forth. Since movies and shopping were topics of other interactive buttons, these types of programs may be filtered out in whole or in part. File card menu 502 has interactive buttons labeled **On Now** 504, **Week-days** 506, **Coming Up** 508, **Weekend** 510, and **Search** 512. As with the file card menu 402, file card menu 502 has an active area that can be moved by the viewer by operation of the arrow buttons 52-56 and double arrow buttons 60, 62 of controller 20 (shown in FIG. 3). Each of the interactive button represents another filtering that will be performed if it is selected. In FIG. 5, the **On Now** button 504 is highlighted, and if selected by actuating the **select (✓)** button 64, causes a third level display shown in FIG. 6 to appear and a further sorting an/or filtering of the data stored within RAM 40 (shown in FIG. 2).

Referring now to FIG. 6, display 600 shows what is on at the present time, which in this illustration is 6:30 p.m. A reduced representation 602 of all television shows that are on at the present time appears in FIG. 6. The reduced representation 602 presents each program that is presently on as a card in a tightly cascaded set of cards. The cards may be gray shade coded to distinguish between news shows, sport shows, dramatic shows, comedy shows, documentary shows and so forth. Those skilled in the art will recognize that color would be preferable for color television sets, and a method and apparatus according to the present invention using color to differentiated program types in the reduced representation 602 is contemplated. Thus, using visual coding within the reduced representation 602 would allow a sports program to visually stand out from the non-sports TV programming in the example shown. Up arrow 52 and Down arrow 54 respectively move a selection window 604, which is slightly wider than the items displayed in reduced representation, up and down the reduced representation 602 of the **On Now** subgroup in single steps. Motion of the active area along the reduced representation 602 is one dimensional, either up or down. The up arrows 60 and the down arrows 62 move this selection window 604 respectively up and down the reduced representation 602 in increments of six. The individual items visible and located within the selection window 604 represent a further subgroup of six programs out of the reduced representation 602 **On Now** subgroup. This six program subgroup of the selection window 604 is displayed in larger form in a grid display 606 located next to reduced representation 602. This larger form allows the viewer to read the titles of the programs presently in grid display 606. The visible coding, i.e. gray shade coding or color coding, of each item is retained in the larger form in grid display 606 to aid the viewer differentiate between the various types of programming offered.

Within selection window 604 and grid display 606 are active areas 605, 607 that highlight one item in their respective portions of display 600. The active areas 605, 607 move in coordination with each other in response to the Up arrow 52 and the Down arrow 54. When Up arrow 52 or Down arrow 54 require the active areas 605 and 607 to move above or below the selection window 604 and grid display 606, a paging occurs which moves the selection window up six or down six. When an item is located within active areas 605, 607, further information, such as the TV channel call sign, the cable channel number, and the exact start and stop times, is retrieved from the programming database stored in RAM 40 and displayed in the top of a frame 610 of display 600. If the **select (✓)** button 64 is actuated at this time, a preview of either a short text description or a brief still or motion video replaces the grid display 606. The data for these previews are stored in RAM 40. A second sequential actuation of the **select (✓)** button 64 actually selects the highlighted program in the active area 604 of reduced representation 602 and formerly highlighted in grid display 606. If the up arrow 52 or the down arrow 54 is actuated the respective preview for the next program item up or down from the previous previewed item is selected. The information displayed in the top of the frame 610 will change to the next program item up or down also. Actuation of the cancel button 66 returns the viewer to the previous arrangement of display 600. The bottom of the frame 610 lists the characteristics of the display 600, which are also retrieved from RAM 40. If the **query (?)** button 68 is actuated, the grid display 606 will be replaced by a generalized help menu. This generalized help menu has many buttons, as explained below, one of which is a view button. If the view button is actuated, the generalized help menu is replaced with the previous select (i.e. filter) view.

Referring now to FIGs. 3, and 7 a selection of a program by category will be described. Actuation of the **query (?)** button 68 of controller 20 causes display 700 to appear on the screen of TV 10 (shown in FIG. 1). On display 700 has a help button 702, a categories button 704, a view button 706, a begin button 708, a favorites button 710, and a user

button 712. An active area, shown on categories button 704 is moved by the arrow buttons 52-58. The function of the view button 706 has been discussed in regard to FIG. 6 and will not be repeated here. Actuation of the help button 702 causes a menu of specific help functions to be displayed. Actuation of the begin button 708 causes the beginning menu to be displayed, i.e. it takes the viewer back to the beginning of the selection sequence. Actuation of the favorites button 710 brings up a list of favorite programs for the present timeslot, which may either be accumulated by the CPU 32 from viewing data or may be entered by the viewer or viewers. Actuation of the viewer button 712, which causes a display to appear where a viewer may interactively enter his or her status as the principal viewer. This information is used to determine, display a slate of favorite programs customized for each viewer. Actuation of the categories button 704 causes a further display 800, which is shown in FIG. 8, to replace display 700 on the screen of TV 10.

Referring now to FIGS. 3, 8 and 9, display 800 has numerous buttons 801, 802, 803, 804, 805, 806, 807, 808, and 809 corresponding to Favorite, Information, Entertainment, Movies, Sports, News, Children, Series and More categories of programming. The buttons 801-809 may be have an active area moved among them using arrows 52-58, or the numeric keypad may be used as a set of hot keys to move the active area to the desired category immediately. The buttons 801-809 are laid out in a 3x3 row and column arrangement just the same as the 1-9 keys of keypad 50 are arranged. Thus, without numbering, intuitive hot key navigation is possible. For example to move the active area to the button in the third column and third row, i.e. button 809, the key in the third column and the third row, i.e. the numeral 9, of keypad 50 is actuated. The button 809 unlike the other buttons which subsequently provide narrower choices, gives another display of buttons for further category choices (not shown). If the active area is around Sports button 805 as shown in FIG. 8, and the **select (✓)** button 64 is actuated, the display shown in FIG. 9 would appear. FIG. 9 is arranged with selection buttons 901-909 in a 3x3 arrangement, similar to that of FIG. 8. Movement of the active area by arrows 52-58 or by hot key is available in FIG. 9, as in FIG. 8. Buttons 901-909 correspond to Baseball, Football, Basketball, Soccer, All, Hockey, Golf, Racing and Other respectively. Except for All button 905, each of the buttons in FIG. 9 represents a narrower subgroup of the overall category of sports. Actuating All button 905 causes display 1000, shown in FIG. 10, to replace, i.e. logically overlay, display 900.

Referring now to FIG. 10, a filtered display for TV programs, that are On Now, for 6:30 p.m. local time as shown in FIG. 10, that are Sports programs showing All categories in reduced representation 1002 is shown. Reduced representation 1002 has so few entries that characteristics of the individual cards that were hidden previously by the sheer number of programs represented can now be discerned. For example, menu card 1003 representing the program **This Week in the NBA** is shorter on the left side than menu card 1004 representing the program **Senior PGA Golf**. The reason for that difference is that the program **This Week in the NBA** starts at 6:30 p.m., while the program **Senior PGA Golf** started at an earlier time as designated by the double left pointing arrows before the title of **Senior PGA Golf** in selection window 1006. Since **This Week in the NBA** and **Senior PGA Goylf** both end at the same time, the right sides of their reduced representations 1003 and 1004 end at the same location. Movement or navigation of the active area 1005 along the reduced representation 1002 is by means of controller 20 the same as in FIG. 6. Each of the six titles shown in selection window 1006 has a respective rectangular region 1010-1015 thereafter. The rectangular regions 1010-1015 are shaded differently according to the type of sports program with which they are associated. These different shades of gray, or different colors if the display is shown on a color TV, are a visual key to the type of sport that corresponds to each of the six titles. Actuating the **select (✓)** button 64 of controller 20 causes display 1106, shown in FIG. 11, which is a text preview of the program highlighted by the active area, to overlay selection area 1006. As mentioned above, actuating the **select (✓)** button 64 at this point will cause CPU 34 to instruct cable interface 30 (shown in FIG. 2) to select that TV program for viewing.

Referring again to FIG. 10 if the status of the method and apparatus is the same as it was just after the selection that caused display 1000 to be shown was made, as described in the previous paragraph, and if the query (?) button 68 is actuated, then the display 700 shown in FIG. 7 with various selections will again be displayed. Further, if view button 706 is actuated, display 1200 as shown in FIG. 12 and its filter selections will logically over lay display 700. Display 1200 has numerous interactive buttons: On Now 1202, Coming Up 1204, Search 1206, Weekdays 1208 and Weekend 1210. Since the All Sports category has been selected previously, if the active area of display 1200 is moved to highlight the Coming Up button 1204 and the button 1204 is actuated, display 1300, shown in FIG. 13 will appear and over lay display 1200.

In display 1300, two coordinate axes are shown which are respectively labeled with two attributes of the of the selected subgroup of data items. The two attributes shown in display 1300 are channels and timeslots for the next 24 timeslots, i.e. 12 hours, coming up. Since the all sports category has been selected, each sports program showing on one of the 300 plus channels within the next 12 hours will be represented in display 1300. Each sports program upcoming is represented by a rectangular 'card' located in the row corresponding to the channel carrying the program and in the column(s) representing the timeslot(s) when it will be shown. Each 'card' is a color coded, reduced representation of the data item for its respective program. The viewer may move the active area 1302 among the cards using the up and down arrows 52, 54 and right and left arrows 56, 58 for movement vertically and horizontally, respectively. As can be seen from display 1300, there are still too many data items in the subgroup to individually consider

in a reasonable amount of time, so further filtering, either by a shorter time period, i.e. **On Now**, or a narrower category, i.e. basketball, is needed. To change to a narrower category, the viewer presses the query (?) button 68 which causes display 700 (shown in FIG. 7) to be displayed. Next, categories button 704 is selected which causes display 900 (shown in FIG. 9) to be displayed. Next, basketball button 903 is selected which causes display 1500 of FIG. 15 to be displayed.

5 The **Coming Up** time filter of FIGs. 12 and 13 has not been changed, so display 1500 shows the basketball programs coming up in the next 12 hours. As can be seen, the two-dimensional grid display 1500 contains approximately sixteen programs, which is sufficiently small to review each item individually in a reasonable time period. Moving active area 1502 around two-dimensional grid display 1500 with the up and down arrows 52, 54 and/or the right and left arrows 56, 58, causes the title and channel of each program to be displayed in the top of the frame of display 1500 to assist the reviewing and selection process. For example, the program highlighted by active area 1502 is "This Week In the NBA" and it is showing on CNN. Thus, by selective filtering the unwieldy display 1300 of programs shown in FIG. 13 is reduced to a manageable handful of display 1500, which the viewer can navigate through individually in a reasonable time.

10 Referring now to FIGs. 16-23, another aspect of the present invention will be described. In FIG. 16 and the remaining figures, a longer period of time is selected other than the one and a half hours or so retrieved by the **On Now** selection. For example, if the viewer wishes to look at the programming available for the rest of the week in order to select something to record on a VCR (not shown). Actuating the button having the number zero (0) of the keypad 50 while watching a program causes the data view menu selection card, such as 900 of FIG. 9, to appear at the point in the menu-display hierarchy where the last selection was made. Actuating the zero (0) button again moves the viewer towards the broadest data view menu 400 of FIG. 4, and the viewer may stop at any display in order to change time or subject matter categories.

15 Thus if a viewer were watching *This Week in the NBA*, and wanted to find a program of interest that is on later, the viewer would first actuate the zero (0) button of keypad 50 which would bring up the display of FIG. 10. Actuating the zero (0) button four more times takes the viewer through displays 900, 800, 700 and 500 of FIGs. 9, 8, 7 and 5 respectively. To get a specific program title, the search button 509 is actuated, which causes FIG. 16 to logically overlay the display 500. FIG. 16 shows a first display 1600 of an interactive alphanumeric selection sequence. First, all alphabetic titles are sorted into groups of five or less. If, for example, **Nova** was the title of the desired program, the active area would be moved from its initial position (either at the top of the display or at the last group selected) to the group of letters containing the letter N using the up arrow 52 or the down arrow 54 as shown in FIG. 17 followed by actuation of the **select (✓)** button 64. This sequence would cause FIG. 18 to logically overlay FIG. 17. In FIG. 18, the active area is moved from its initial location at M to the location of N as shown in FIG. 17 followed again by actuation of the **select (✓)** button 64 causes the display 2000 of FIG. 20 to overlay FIG. 19. In display 2000 are single instances of the first two letters, such as NYPD Blue is the only instance of N followed by Y, and multiple instances of the two letter string as denoted by the double right pointing arrows by NO. To continue the search for **Nova**, the active area is moved to the line containing NO of display 2000 as shown in FIG. 21 using the down arrow 56 and actuating the **select (✓)** button 64, which causes display 2200 of FIG. 22 to overlay display 2000. Now, **Nova** is the only instance of a program beginning with NOV, so the entire title **Nova** appears in FIG. 22. By moving the active area to the line labeled NOVA in display 2200 and actuating the **select (✓)**, button 64 causes the display 2300 shown in FIG. 23 to overlay display 2200 with a schedule of times and channels for the program series **Nova**.

20 FIG. 23 is a one week schedule that is laid out as a logical three dimensional grid. The days of the week are displayed along one side, in this case vertically along the left side, of the display 2300. Time of day is displayed along a perpendicular side, in this case horizontally across the top, for a twenty-four hour period. Thus, if an episode of **Nova** is scheduled at 8:00 p.m. on Sunday, a box of contrasting shade will be located in the intersection of the Sunday row and in the 8:00 p.m. column. The active area 2302 can be moved horizontally by arrows 56, 58 and vertically by arrows 52, 54 of keypad 50. If there are multiple occurrences of **Nova** on a particular night at a particular time, that fact is shown by a box, located at the intersection of the row of that day and the column of that time, having an asterisk (\*) located in the box. The asterisk (\*) indicates the presence of a logical stack of multiple programs of **Nova** appearing on competing channels, such as occurs on Wednesday night at 8:00 p.m. To move or navigate through a stack of programs (or stack of episodes of programs with the same name, for example) on a particular day at a particular time slot, the viewer uses the double up arrows button 60 and the double down arrows button 62 for this third degree of freedom. Because the display 2300 may require greater visual discrimination than program title as a matter of course, the frame information window 1904 is larger than usual for display 2300. Further, frame 2304 is annotated with arrows indicating the existence of program episodes above or below the active areas' position in the stack. If the cable 16 has access to 300 plus 'channels' of programming, it is conceivable that some programs, such as **Nova** will be offered by more than one channel at the same time. As described previously, once the viewer has moved the active area to a particular entry in two or three dimensions and actuates the **select (✓)** button 64, a selection is made. In this case, the selection sets an alarm to record a specific channel at a specific time at some day in the near future.

25 Referring back to FIGs. 1 and 2, overall operation of the apparatus of the invention is described. Program schedule

5 data is supplied via the cable 16. The program schedule data is either transmitted periodically and the STB 12 receives this program schedule data and stores it in RAM 40. Alternatively, all or part of the program schedule data could be dynamically requested and received by STB 12, which stores it in RAM 40. Program data such as this is commercially available from TVData, Inc. and other similar concerns. The data or records of the program schedule data are in a pre-arranged format, such as Microsoft Access or some other similar database format, to facilitate rapid storage, sorting and retrieval by CPU 34. Each record of a TV program has its date of appearance, its time of appearance, its title, its channel and/or network, its categorizations, and a textual or visual preview (if any). A listing of a prototype program that sorts, displays and interactively responds to a viewer's input is shown in the CPU program listing given below. This listing is in Visual Basic programming language of Microsoft Corporation.

10 The Visual Basic prototype program consists of a collection of forms, each form having its own set of event handlers. In this case, the only significant external events are button actuations because of the remote control interface. A frame form provides the background and information and status bars used by most of the individual displays. A rolodex form provides the menus. The other forms are mostly schedule or list displays of various kinds, including specialized varieties such as the alphanumeric selection list form.

15 The control part of the program begins with a procedure which loads all forms and activates the frame and rolodex, i.e. the top display, to begin. Forms hand off control by setting a return code and hiding themselves, thereby activating the form directly beneath (usually the frame). Both the frame form and the rolodex form perform different actions depending on the value of the return code. The frame form's most common action is to activate another form, and much of the control flow of the application is handled by the frame form code. The rolodex form is used to display several 20 different menu hierarchies, most importantly view selection and filter choice.

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===== COMING form code =====
This form displays a TV schedule for several hours of one day.
This version uses drawing methods for the program shapes
as opposed to creating a control shape for each program)
and "point & shoot" or "visually closest" navigation.

5      Option Explicit
Dim allData(8) As snapshot 'all data within time period
Dim filterData(8) As snapshot 'a snapshot for each day in the view
10     Dim NDays As Integer      'number of days in display
Dim NSlots As Integer       'number of time slots in display
Dim NStation As Integer      'number of stations in display
Dim MaxStation As Integer    'total number of stations in database
Dim colorField As String     'the database field that determines item color
15     ' (the field should contain an integer)
Dim inPreview As Integer    'boolean 'should the preview message show?
Const sideGap = .05 'space at beginning and end of program
Const topGAP = 4 'space btwn time label and first program shape
Dim refDate 'reference date for data time slots
20     Const lblHeight = 40      'height of day and time labels (in 500 scale)
Const MINProgWidth = .2      'minimum width of a program shape as fraction of slot
Dim slotsPerDay As Integer   'number of slots allowed per day
Dim currDay 'number of current day
Dim startTime 'start day and time of display

25     Dim TSBegin As Long      'first time slot
Dim TSEnd As Long           'last time slot
Dim TScurrent As Long        'current time slot
Dim rowOffset 'distance between (tops of) rows in the schedule

30     Sub ApplyFilter()
'filter program data, keeping only the programs that match the query in filters(TV)
'also makes sure the number of stations is correct
'and the DB field determining the color is set
    Dim i As Integer 'counter

35     If InStr(filters(currDomain), "Station") Then
        NStation = 10 'note: this probably should be a variable or const, not 10
        colorField = "Type"
    Else
        NStation = MaxStation
        colorField = "Category"
    End If
    For i = 1 To NDays
        allData(i).Filter = filters(currDomain)
        Set filterData(i) = allData(i).CreateSnapshot()
    Next i
45     End Sub

Sub ChangeSel 'd As String
'Performs the navigation according to the direction parameter
    Dim current, firstMatch 'database markers
    Dim success As Integer 'boolean
    Dim s As Integer 'station
50

```

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Dim e           'FinishTS (end)
Dim TS As Long   'time-slot
Dim F As snapshot
Dim aDay As Integer
Dim dist 'distance
Dim best As Long, bestMark 'as database marker

5
      'set info about current place in database
      current = filterData(currDay).Bookmark
10     Set F = filterData(currDay)
      s = F("Station")
      e = F("FinishTS")
      TS = TScurrent
      aDay = currDay
15     success = False
      best = 9999

      If d = "Right" Then
          'check immediate right
          F.MoveNext
20        If Not F.EOF Then
              TS = F("StartTS")
              'success = same station and starts right after current program
              success = (F("Station") = s) And (TS <= e + 1)
            End If
25        If Not success Then
            'check all to right for "closest"
            F.MoveFirst
            While Not F.EOF
              If F("FinishTS") > e Then
                dist = VDistHoriz(s, e, F("Station"), F("StartTS"))
30                If dist <= best Then
                  'save best so far
                  best = dist
                  success = True
                  bestMark = F.Bookmark
35                End If
              End If
              F.MoveNext
            Wend
            If success Then
              'move to the best one
40              F.Bookmark = bestMark
              TS = F("StartTS")
              End If
            End If
45        ElseIf d = "Left" Then
          'check immediate left
          F.MovePrevious
          If Not F.BOF Then
            'success = same station and finishes right before current program
            success = (F("Station") = s) And (F("FinishTS") >= TS - 1)
50            TS = F("StartTS")
          End If

```

```

If Not success Then
  'check all to left for "closest"
  F.MoveFirst
5   While Not F.EOF
    If F("StartTS") < TScurrent Then
      dist = VDistHoriz(F("Station"), F("FinishTS"), s, TScurrent)
      If dist < best Then
        'keep best so far
        best = dist
        success = True
        bestMark = F.Bookmark
      End If
    End If
    F.MoveNext
15  Wend
    If success Then
      'move to best one
      F.Bookmark = bestMark
      TS = F("StartTS")
    End If
20  End If
ElseIf d = "Down" Then
  'check all programs below current one, keeping "closest"
  While Not F.EOF
    If F("Station") > s Then
25  dist = VDistVert(s, TScurrent, e, F("Station"), F("StartTS"),
  F("FinishTS"))
      If dist < best Then
        best = dist
        success = True
        bestMark = F.Bookmark
      End If
    End If
    F.MoveNext
30  Wend
    If success Then
      F.Bookmark = bestMark
      TS = F("StartTS")
    End If
35  ElseIf d = "Up" Then
    'check all programs above current one, keeping "closest"
    While Not F.BOF
      If F("Station") < s Then
40  dist = VDistVert(s, TScurrent, e, F("Station"), F("StartTS"),
  F("FinishTS"))
        If dist < best Then
          best = dist
          success = True
          bestMark = F.Bookmark
        End If
      End If
      F.MovePrevious
45  Wend
    If success Then

```

```

      F.Bookmark = bestMark
      TS = F("StartTS")
    End If
  End If

  5   If success Then
    'update variables and display
    TScurrent = TS
    currDay = aDay
    DisplayProg
  Else
    'restore old position in database
    filterData(currDay).Bookmark = current
  End If
End Sub

10
15

Sub DisplayProg ()
  'set current program info in info box
  'highlight the appropriate program shape in the display
  Dim F As snapshot
  Dim msg As String

  Set F = filterData(currDay)

  'set highlight
  20   shpProg(0).Visible = False
  selector.Visible = False
  Position shpProg(0), F("Start"), F("Finish"), F("Station")
  CPlace 0, selector, shpProg(0)
  shpProg(0).Visible = True
  selector.Visible = True

  25
  30   'message for info box
  msg = StationString(F("Station")) & " - " & F("Title") & " "
  msg = msg & Format(F("Start"), "h:mm AM/PM")
  msg = msg & " to " & Format(F("Finish"), "h:mm AM/PM")
  35   SetInfo msg, Color(F(colorField) Mod 9)
End Sub

Sub DoPreview ()
  'Construct an appropriate preview message and display it
  40   Dim msg As String

  msg = "Station: " & StationString(filterData(currDay)("Station"))
  msg = msg & Chr(13) & "Title: " & filterData(currDay)("Title") & Chr(13)
  msg = msg & CategoryString((filterData(currDay)("Type")))
  (filterData(currDay)("Category"))
  45   msg = msg & Chr(13) & "Time: " & Format(filterData(currDay)("Start"), "mm dd,yy
h:mm AM/PM")
  msg = msg & Chr(13) & "      to " & Format(filterData(currDay)("Finish"), "h:mm
AM/PM")

  50   'show popup with preview message
  popup.Caption = msg

```

```

5      popup.Top = lblTime(1).Top + 2 * lblTime(1).Height
       popup.Left = 2
       popup.Width = slotsPerDay - 3
       popup.Visible = True
       inPreview = True
   End Sub

10     Sub DoSelect ()
       'set selection info and go to TV
       userStation = filterData(currDay) ("Station")
       userStart = filterData(currDay) ("Start")
       returnCode = TOTV
       Me.Hide
   End Sub

15     Sub DrawProg (colorIndex, start, finish, station)
       'use drawing methods to draw a program shape
       'note: form.AutoRedraw should be set to true so the drawings are persistant
       Dim L, R, t, B  'left, right, top, bottom
       Dim dayStart
       Dim edge

20         'convert a day/time to position in NSlot scale
       dayStart = startTime + currDay - 1
       L = (start - dayStart) * 48
       R = (finish - dayStart) * 48
       'clip shapes off at day boundaries
       If L < 0 Then L = 0
       If R > slotsPerDay Then R = slotsPerDay
       'place in correct day, with small gap between programs
       edge = (currDay - 1) * slotsPerDay
       L = L + edge + sideGap
       R = R + edge - sideGap
       'correct for min width to make sure program will show up
       If R - L < MINProgWidth Then R = L + MINProgWidth
       'set top according to station
       'note: this trick will not work if "favorite stations" are not numbered 1..n
       rowOffset = ((500 - 2 * lblHeight - shpProg(0).Height) / NStation)
       t = shpSlot(0).Top + topGAP + (station - 1) * rowOffset
       B = t + shpProg(0).Height
       'draw the box with the correct color
       drawwidth = 1
       Me.FillStyle = 0 'solid
       Me.FillColor = Color(colorIndex Mod 9)
       Line (L, t)-Step(R - L, B - t), , B  'the line command with argument B draws a
box
   End Sub

45     Sub Form_Activate ()
       'make necessary changes to display, reset info and status bars
       Dim i As Integer 'counter
       Static saveFilter As String

50       If saveFilter = filters(currDomain) Then sameFilter = True

```

```

    saveFilter = filters(currDomain)
    SetStatus "TV Coming Up: " & currFilter(TV), greyCOLOR
    If newUser Then
        popup.Caption = "Press 'category' to change the kind of programs displayed."
        popup.Visible = True
        newUser = False
    End If

    'if not same filter, redo display
    If Not sameFilter Then
        SetInfo "Loading program information...", GREY
        shpProg(0).Visible = False
        selector.Visible = False
        ApplyFilter
        MakeDisplay
    End If

    'in every case
    DisplayProg
    If inPreview Then DoPreview
End Sub

Sub Form_KeyDown (KeyCode As Integer, Shift As Integer)
    Select Case KeyCode
        Case Asc("Q")
            End
        Case B_BACK
            returnCode = BACK
            Me.Hide
        Case B_HELP
            InvokeHelp
        Case B_PREVIEW
            If inPreview Then
                popup.Visible = False
                inPreview = False
            Else
                inPreview = True
            End If
        Case B_RIGHT
            If Not filterData(currDay).EOF Then ChangeSel ("Right")
        Case B_LEFT
            If Not filterData(currDay).EOF Then ChangeSel ("Left")
        Case B_UP
            If Not filterData(currDay).EOF Then ChangeSel ("Up")
        Case B_DOWN
            If Not filterData(currDay).EOF Then ChangeSel ("Down")
        Case B_SELECT
            If Not filterData(currDay).EOF Then DoSelect
        Case B_PAGEDOWN
        Case B_PAGEUP
        Case B_FILTER
            returnCode = Filter
            Me.Hide
        Case B_0

```

```

    returnCode = SHORTCUT
    Me.Hide
End Select
5

    'in any case
    If inPreview Then
        DoPreview
    Else
        popup.Visible = False
    End If
End Sub

Sub Form_Load()
    Dim i As Integer
15    Dim t 'as time

    'set form colors and fonts
    Me.BackColor = formCOLOR
    shpProg(0).BackColor = BorderColor
    lblDay(0).BackColor = backgroundCOLOR
20    lblAM.BackColor = backgroundCOLOR
    lblPM.BackColor = backgroundCOLOR
    selector.BorderColor = BorderColor
    dayLine(0).BorderColor = divideColor
    lblTime(0).ForeColor = slotCOLOR
    25    shpSlot(0).BorderColor = slotCOLOR
    If displayMode = "TV" Then
        lblDay(0).FontSize = smallFONT
        lblTime(0).FontSize = smallFONT
        lblAM.FontSize = smallFONT
        30    lblPM.FontSize = smallFONT
        popup.FontSize = mediumFONT
    Else
        35    lblDay(0).FontSize = largeFONT
        lblTime(0).FontSize = largeFONT
        lblAM.FontSize = largeFONT
        lblPM.FontSize = largeFONT
        popup.FontSize = largeFONT
    End If
    'set scale and size objects'
    SizeAForm Me, DispTop, DispHeight, DispLeft, DispWidth
40    Me.Scale (0, 0)-(500, 500)
    SizeAControl lblDay(0), 0, lblHeight, 0, 500
    'note: the AM/PM labels would be placed when time is filtered
    SizeAControl lblPM, 0, lblHeight, 0, 30
    SizeAControl lblAM, 0, lblHeight, 500 - 30, 30
    45    SizeAControl lblTime(0), lblHeight, lblHeight, 0, 50
    SizeAControl shpSlot(0), 2 * lblHeight + .5 * topGAP, 500 - 2 * lblHeight, 0, 50
    SizeAControl popup, 250, 200, 250, 200
    selector.BorderWidth = 1
    dayLine(0).Y1 = 0
    dayLine(0).Y2 = 500
    'initialize variables
50

```

```

    startTime = fakeToday + fakeTime 'this would be set at activate to current half
hour
5      NDays = 1
       slotsPerDay = 24
       NSlots = NDays * slotsPerDay
       sameFilter = False
       sameView = False
       inPreview = False
10     'set form scale and place permanent stuff (day and time labels)
       Me.ScaleWidth = NSlots
       Load lblDay(1)
       SizeACControl lblDay(1), 0, lblHeight, 0, slotsPerDay
       lblDay(1).Caption = DayString(startTime, "long")
       lblDay(1).Visible = True
15     lblTime(0).Width = 1
       For i = 1 To slotsPerDay
         Load lblTime(i)
         lblTime(i).Move i - 1
         t = DateAdd("n", 30 * (i - 1), startTime) 'add 30 minute increments
20     lblTime(i).Caption = TimeLabel(t)
         lblTime(i).Visible = True
         lblTime(i).ZOrder
       Next i

25     InputData
       Form_Activate
       sameView = True
     End Sub

30     Sub InputData ()
       'part of form_load
       'opens the database and creates allData snapshots

       Dim DB As database
       Dim RefSnap As snapshot

35     Set DB = OpenDatabase(TVDB)

       'get reference date and number of stations
       Set RefSnap = DB.CreateSnapshot("Reference")
       RefSnap.FindFirst "Name = 'Date'"
       refDate = DateValue(RefSnap("Data"))
       RefSnap.FindFirst "Name = 'NStations'"
       MaxStation = Val(RefSnap("Data"))

40     Set allData(0) = DB.CreateSnapshot("Programs")
       'assumes data already sorted

45     'filter for particular time period, would happen at each half-hour change
       TSBegin = Abs(DateDiff("n", startTime, refDate) \ 30)
       TSEnd = TSBegin + slotsPerDay - 1 'check that slotsPerDay is set
       allData(0).Filter = Overlap(TSBegin, TSEnd)
       Set allData(1) = allData(0).CreateSnapshot()
       Set allData(0) = Nothing 'won't be needing everything
50

```

```

End Sub

Sub MakeDisplay ()
    'create the display of programs from the data
    Dim i As Integer 'counter
    Dim d As Integer 'day
    Dim F As snapshot 'convenience

    If Not sameView Then
        'would need to reset captions for times and day
    End If

    'place program shapes
    Cls 'clear the form of previous drawings
    DoEvents 'make it so
    For d = 1 To NDays
        currDay = d
        'draw lines to separate time slots
        For i = 0 To slotsPerDay
            drawwidth = 4
            Line (i, shpSlot(0).Top)-(i, 500), slotCOLOR
        Next i
        'draw program shape for each program in data
        Set F = filterData(d)
        If Not F.EOF Then
            F.MoveFirst
            Do While Not F.EOF
                DrawProg F(colorField), F("Start"), F("Finish"), F("Station")
                F.MoveNext
            Loop
            F.MoveFirst
        End If
    Next d

    'initialize stuff
    TScurrent = TSBegin
    currDay = 1
    shpProg(0).ZOrder
    selector.ZOrder
    Set F = filterData(currDay)
    'find a program to start on
    Do While TScurrent <= TSEnd
        F.FindFirst Overlap(TScurrent, TScurrent)
        If Not F.NoMatch Then
            DisplayProg
            Exit Do
        End If
    TScurrent = TScurrent + 1
    Loop
    'make sure TScurrent is in range
    If TScurrent > TSEnd Then TScurrent = TSBegin
End Sub

Sub Position (shape As Control, start, finish, station)

```

```

'position a program shape control
Dim relativeL, relativeW, dayStart
Dim edge
'convert a day/time to position in NSlot scale
dayStart = startTime + currDay - 1
relativeL = (start - dayStart) * 48
relativeW = (finish - dayStart) * 48 - relativeL
'clip shapes off at day boundaries
If relativeL < 0 Then
    relativeW = relativeW + relativeL
    relativeL = 0
End If
If relativeW + relativeL > slotsPerDay Then relativeW = slotsPerDay - relativeL
'set left and width of shape. leaving small gap between programs
edge = (currDay - 1) * slotsPerDay
shape.Left = relativeL + edge + sideGap
shape.Width = relativeW - 2 * sideGap
'set minimum width so program is visible
If shape.Width < MINProgWidth Then shape.Width = MINProgWidth
'set top according to station
'note: this will not work if "favorite" stations are not numbered 1..n
rowOffset = ((500 - 2 * lblHeight - shpProg(0).Height) / NStation)
shape.Top = shpSlot(0).Top + topGAP + (station - 1) * rowOffset
End Sub

Function VDistHoriz (station1, finish, station2, start)
'computes a value for the "visual" left-right distance between two programs
'requires that the earlier program come first
'note: needs refinement, does not work satisfactorily, especially with crowded
displays
    Dim deltaR, deltaT 'change in row and time
    Dim row1, row2

    row1 = station1
    row2 = station2
    'note: row calculations could be more complicated if stations not numbered 1..n
    deltaR = Abs(row1 - row2) * (100 / NStation)
    deltaT = (start - finish) * (100 / slotsPerDay)
    'penalize programs that are more up/down than to side
    If deltaT <= 1 Then deltaT = (finish + 3 - start) * (100 / slotsPerDay)
    If deltaT < 1 Then deltaT = 100 / slotsPerDay'don't allow zero
    VDistHoriz = deltaR + deltaT
End Function

Function VDistVert (station1, start1, finish1, station2, start2, finish2)
'computes a value for the "visual" up-down distance between two programs
'note: needs refinement
    Dim deltaR, deltaT 'change in row and time
    Dim row1, row2

    row1 = station1
    row2 = station2
    'note: row calculations could be more complicated if stations not numbered 1..n
    deltaR = Abs(row1 - row2) / NStation

```

```

    If start1 > finish2 Then
        deltaT = Abs(start1 - finish2)
    ElseIf start2 > finish1 Then
        deltaT = Abs(start2 - finish1)
    Else
        deltaT = 0
    End If
    VDistVert = deltaR + 2 * deltaT
End Function

10

' ===== FRAME form code =====
'This form owns the standard info and status bars and allows
't transfer of control from form to form.
Option Explicit

15
Sub Form_Activate ()
'decides which other form should show in its display area
    Select Case returnCode
        Case SHOWVIEW
            views(currDomain).Show
        Case PICK
            frmSelect.Show
        Case TOTV
            frmTV.Show
        Case LASTVIEW
            sameFilter = True
            views(currDomain).Show
        Case STARTUP
            'do nothing--don't want rolodex to show yet
        Case Else
            frmDex.Show
    End Select
End Sub

20

30

Sub Form_KeyDown (KeyCode As Integer, Shift As Integer)
    If KeyCode = Asc("Q") Then
        End
    End If
End Sub

35

Sub Form_Load ()
    'set colors and fonts
    Me.BackColor = formCOLOR
    sspInfo.FontSize = mediumFONT
    sspStatus.FontSize = mediumFONT
    'use builtin object to size background
    ScrWidth = Screen.Width
    40
    ScrHeight = Screen.Height
    If displayMode = "mini" Then
        'for taking screen prints
        ScrHeight = ScrHeight * .54
        ScrWidth = ScrWidth * .712
        displayMode = "TV"
    Else
    45
    50

```

```

      'resize to fit TV
      ScrHeight = ScrHeight * .83
End If
5   'set form to fill screen
frmFrame.Top = 0
frmFrame.Height = ScrHeight
frmFrame.Left = 0
frmFrame.Width = ScrWidth
10  'info line at top of screen
sspInfo.Visible = True
'status line at bottom of screen
sspStatus.Visible = True
'define available display area
DispTop = sspInfo.Height + 1.5
15  DispHeight = frmFrame.Height - (sspStatus.Height + 1.5) - DispTop
DispLeft = 0
DispWidth = frmFrame.Width
End Sub

20  Sub SetupStatus ()
End Sub

'===== LIST form code =====
'This code is used for all three list forms (TV, Movies, Shopping)
Option Explicit
25  Dim DB As database 'full database with indexes

Dim BlinkControl As Control 'set to blinking object (currently none)
Dim itemSelected As Integer 'from 1 to MAXDISPLAY
Dim locSelected As Integer 'from 1 to MAXLOC
30  Dim inPreview As Integer 'boolean
Dim captionField As String 'the database field that is used for display
Dim startTime 'the start time for the TV list
Dim TS As Long 'the time slot for the TV list
Dim rowOffset 'difference between tops of two consecutive reduced items
Dim browsing As String 'type of current shopping list
35  Dim colorField As String 'field which determines color (should be of type integer)

'display parameters
Const MAXDISPLAY = 6 'Number of items in close up
Dim MAXITEM As Integer 'Number of items in whole list
Dim MAXLOC As Integer 'Number of locator positions
40  Dim whichrItem(MAXDISPLAY) As Integer 'which rItems are in the current display

#define sizes of locator and selector
Const GAP = 10 'space around lists
Const EXTRA = 70 'room for longer programs
45  Const reducedEXTRA = 20 'room for longer programs in reduced rep
Const T = 50 'reduced list
Const H = 1000 - 2 * T
Const locL = 30 'display area
Const locW = 100
50  Const dispL = locW + 2 * locL
Const dispW = 1000 - dispL - locL

```

```

'database snapshots
5   Dim allData As snapshot
    Dim itemData As snapshot
    Dim storeData As snapshot
    Dim deptData As snapshot
    Dim stuffData As snapshot
    Dim filterData As snapshot
10  Dim marker(1000) As String 'bookmarks of each MAXDISPLAY items
    Dim locStart(1000) 'rItem index for start of locator

Sub ApplyFilter ()
'filter the data according to user choice
    Dim sortString As String
15
    If Me Is TVlist Then
        captionField = "Title"
        sortString = ""
        colorField = "Type"
    ElseIf Me Is MOVlist Then
        If sameView Then
            'keep allData as it is
        Else
            'reset allData to all movies
            LoadData
25        allData.Filter = viewFilter
            Set allData = allData.CreateSnapshot()
        End If
        captionField = "Title"
        sortString = "Title"
        colorField = "Type"
30    ElseIf Me Is SHOPlist Then
        'note: This would all be done totally differently. Don't bother
        '      understanding it, just rewrite it.
        Select Case filters(currDomain)
        Case "store"
35            browsing = "store"
            Set allData = storeData
            captionField = "name"
            filters(currDomain) = ""
            sortString = "name"
            colorField = ""
        Case "dept"
40            browsing = "dept"
            deptData.FindFirst "name = '" & userString & "'"
            userString = "" 'fix--this is cheating, I shouldn't use userString
            If deptData.NoMatch Then
45                Set allData = deptData
                filters(currDomain) = ""
            Else
                browsing = "stuff"
                filters(currDomain) = "[dept code] = " & deptData("code")
50                Set allData = stuffData
            End If

```

```

      captionField = "name"
      sortString = "name"
      colorField = ""
5       Case "item"
             browsing = "item"
             Set allData = itemData
             captionField = "name"
             colorField = ""
10            filters(currDomain) = "name like '" & userString & "'"
             sortString = "name"
15            Case Else
                     browsing = "stuff"
                     captionField = "name"
                     sortString = "name"
                     colorField = "[item code]"
                     Set allData = stuffData
             End Select
End If

20   allData.Filter = filters(currDomain)
If filters(currDomain) = "" Then
    allData.FindFirst "Not " & captionField & " = ''"
Else
    allData.FindFirst allData.Filter
End If
25   If allData.NoMatch Then
        MAXITEM = 0
Else
        MAXITEM = 1 'temporary setting just to make sure it isn't 0
        Set filterData = allData.CreateSnapshot()
        filterData.Sort = sortString
30        Set filterData = filterData.CreateSnapshot()
End If
End Sub

Sub BlinkStart (C As Control, vis)
35   Set BlinkControl = C
   BlinkControl.Visible = vis
   tmrBlink.Enabled = True
End Sub

Sub BlinkStop (vis)
40   tmrBlink.Enabled = False
   If BlinkControl Is Nothing Then
       'do nothing
   Else
       BlinkControl.Visible = True
   End If
45   Set BlinkControl = Nothing
End Sub

Sub ChangeLoc (direct As String)
'page up or down with the locator
50   Select Case direct

```

```

Case "Up"
  If locSelected > 1 Then
    locSelected = locSelected - 1
    RedoDisplay
5   End If
Case "Down"
  If locSelected < MAXLOC Then
    locSelected = locSelected + 1
    RedoDisplay
10  End If
End Select
End Sub

Sub ChangeSel (direct As String)
15  'navigate up or down one selection
  Select Case direct
    Case "Up"
      If itemSelected > 1 Then
        'move up within current display
        itemSelected = itemSelected - 1
        selector.Top = itemBox(itemSelected).Top - GAP
20        rItem(0).Top = rItem(whichrItem(itemSelected)).Top
        rItem(0).Left = locL - GAP
        rItem(0).Width = locW + 2 * GAP
        SetItemInfo
      ElseIf locSelected > 1 Then
        'display previous section of list
        itemSelected = MAXDISPLAY
        locSelected = locSelected - 1
        RedoDisplay
25      End If
    Case "Down"
      If itemSelected < MAXDISPLAY Then
        'move down within current display
        'do not move to select an empty item
        If (locSelected - 1) * MAXDISPLAY + itemSelected < MAXITEM Then
30        itemSelected = itemSelected + 1
          selector.Top = itemBox(itemSelected).Top - GAP
          rItem(0).Top = rItem(whichrItem(itemSelected)).Top
          rItem(0).Left = locL - GAP
          rItem(0).Width = locW + 2 * GAP
          SetItemInfo
40        End If
      ElseIf locSelected < MAXLOC Then
        'display next section of list
        itemSelected = 1
        locSelected = locSelected + 1
        RedoDisplay
45      End If
    End Select
    rItem(0).Visible = True
  End Sub

50  Sub DoPreview ()

```

```

'show preview window and preview locator
Dim i As Integer 'counter

5      inPreview = True

    'hide other stuff
    locator.Visible = False
    selector.Visible = False
    For i = 1 To MAXDISPLAY
        itemBox(i).Visible = False
        leftArrow(i).Visible = False
        rightArrow(i).Visible = False
    Next i

10     previewWin.Caption = "Getting preview..."
    previewWin.ZOrder
    previewWin.Visible = True

    ShowPreview
20     End Sub

Sub DoSelect ()
    'act on the current selected item

    If Me Is TVlist Then
        'set selection data and go to TV
        userStation = filterData("Station")
        userStart = filterData("Start")
        returnCode = TOTV
        Me.Hide
    ElseIf Me Is MOVlist Then
        'display "order movie" message
        sameFilter = True
        TellUser "You would be asked to confirm your order of " &
filterData("Title")
    ElseIf Me Is SHOPlist Then
        Select Case browsing
            Case "stuff"
                sameFilter = True
                TellUser "You would be asked to confirm your order of " &
filterData("name")
            Case "store"
                filters(currDomain) = "[store code] = " & filterData("code")
                Form_Activate
            Case "item"
                filters(currDomain) = "[item code] = " & filterData("code")
                Form_Activate
45        Case "dept"
                filters(currDomain) = "[dept code] = " & filterData("code")
                Form_Activate
            End Select
        End If
50     End Sub

```

```

Sub EndPreview ()
  'go back to regular list operation
  Dim i As Integer 'counter
  previewWin.Visible = False
  inPreview = False
  locator.Visible = True
  selector.Visible = True
  previewWin.Top = displayList.Top
  RedoDisplay
End Sub

Sub Form_Activate ()
  Dim i As Integer 'counter
  Dim section As Integer 'count the number of locator locations
  Dim NVisible As Integer 'tally the visible shapes in a section
  Dim msg As String
  Static saveFilter As String
  Static saveView As String

  'check new filters against current filters
  If Not sameView Then sameView = (saveView = viewFilter)
  saveView = viewFilter
  If Not sameFilter Then sameFilter = (saveFilter = filters(currDomain))
  saveFilter = filters(currDomain)

  SetStatus currView(currDomain) & currFilter(currDomain), greyCOLOR

  If sameFilter And sameView Then
    'keep everything the same as last time
    If newUser And Not Me Is SHOPlist Then
      popup.Caption = "To change the category shown, press the 'Category' button."
      popup.Visible = True
      newUser = False
    End If
    RedoDisplay
  Else
    'clean up display
    SetInfo "Selecting data, please wait...", GREY
    If MAXITEM = 0 Then
      previewWin.Caption = ""
      previewWin.Visible = False
    End If
    DoEvents
    If inPreview Then EndPreview

    For i = 1 To MAXDISPLAY
      itemBox(i).Caption = ""
    Next i

    For i = 1 To MAXITEM
      Unload rItem(i)
    Next i
  End If
End Sub

```

```

'filter new data
ApplyFilter
5 If MAXITEM = 0 Then
    'give "no matches" msg
    locator.Visible = False
    rItem(0).Visible = False
    For i = 1 To MAXDISPLAY
        MAXITEM = 0
        itemBox(i).Visible = False
        leftArrow(i).Visible = False
        rightArrow(i).Visible = False
    Next i
    previewWin.Caption = "No matches were found" & Chr(13)
10 previewWin.Caption = previewWin.Caption & "Press 'Category' to change
the selection."
    previewWin.ZOrder
    previewWin.Visible = True
    itemSelected = 0
    locSelected = 0
20 Else
    'redo list display
    filterData.MoveLast
    MAXITEM = filterData.RecordCount
    'set distance between items
25 rowOffset = (H - rItem(0).Height) / MAXITEM
    If rowOffset > rItem(0).Height + GAP Then rowOffset = rItem(0).Height +
GAP 'max distance
    rItem(0).Visible = False
    rItem(0).Top = T
30 rItem(0).Left = locL + reducedEXTRA
    rItem(0).Width = locW - 2 * reducedEXTRA
    rItem(0).BackColor = itemCOLOR
    filterData.MoveFirst
    'size and place the item shapes
    'and set section bookmarks
35 section = 0      'number of locator locations
    NVisible = MAXDISPLAY 'so first section will be marked correctly
    For i = 1 To MAXITEM
        Load rItem(i)
        If colorField <> "" Then
            rItem(i).BackColor = Color(Val(filterData(colorField)) Mod 9)
40 End If
        NVisible = NVisible + 1
        rItem(i).Top = T + (i - 1) * rowOffset
        If NVisible > MAXDISPLAY Then
            'begin a new locator location
            45 section = section + 1
            locStart(section) = i
            marker(section) = filterData.Bookmark
            NVisible = 1
            End If
            If Me Is TVlist Then
                50 'set length of reduced item

```

```

      If filterData("StartTS") < TS Then
          rItem(i).Left = rItem(i).Left - reducedEXTRA
          rItem(i).Width = rItem(i).Width + reducedEXTRA
5       End If
      If filterData("FinishTS") > TS Then
          rItem(i).Width = rItem(i).Width - reducedEXTRA
      End If
    End If
    rItem(i).ZOrder
    rItem(i).Visible = True
    filterData.MoveNext
10   Next i
    MAXLOC = section
    locStart(section + 1) = MAXITEM + 1
15
    'set length of minselector (use rItem(0))
    rItem(0).Left = locL - GAP
    rItem(0).Width = locW + 2 * GAP

20   'initialize selector and locator
    itemSelected = 1
    locSelected = 1
    locator.Visible = True
    rItem(0).BackColor = highlightCOLOR
    'set the captions in the itemBoxes
25   RedoDisplay
    End If
  End If
End Sub

30   Sub Form_KeyDown (KeyCode As Integer, Shift As Integer)
    popup.Visible = False
    Select Case KeyCode
      Case Asc("Q")
        End
      Case B_BACK
        If Me Is SHOPlist And browsing = "item" Then
          'not exactly what we want
          returnCode = ALPHA
          Me.Hide
        Else
          returnCode = BACK
          Me.Hide
        End If
      Case B_HELP
        InvokeHelp
      Case B_PREVIEW
45     If inPreview Then
          EndPreview
        Else
          DoPreview
        End If
      Case B_SELECT
        If MAXITEM > 0 Then DoSelect
50

```

```

Case B_UP
    If MAXITEM > 0 Then ChangeSel ("Up")
Case B_DOWN
    If MAXITEM > 0 Then ChangeSel ("Down")
Case B_RIGHT
    If Me Is TVlist Then
        returnCode = COMING
        Me.Hide
    End If
10 Case B_LEFT
Case B_PAGEUP
    If inPreview Then
        'scroll preview
        If previewWin.Top < displayList.Top Then
            'move preview window down a screen
            previewWin.Top = previewWin.Top + displayList.Height
        End If
    Else
        If MAXITEM > 0 Then ChangeLoc ("Up")
    End If
20 Case B_PAGEDOWN
    If inPreview Then
        'scroll preview
        If previewWin.Top + previewWin.Height > displayList.Top +
displayList.Height Then
            'move preview window up a screen
            previewWin.Top = previewWin.Top - displayList.Height
        End If
    Else
        If MAXITEM > 0 Then ChangeLoc ("Down")
    End If
30 Case B_FILTER
    If Not Me Is SHOPlist Then
        returnCode = Filter
        Me.Hide
    End If
35 Case B_0
    returnCode = SHORTCUT
    Me.Hide
End Select
End Sub

40 Sub Form_Load ()
    Dim i As Integer 'counter
    Dim itemRoom

    'set colors and fonts
45    itemBox(0).FontSize = largeFONT
    leftArrow(0).FontSize = largeFONT
    rightArrow(0).FontSize = largeFONT
    If displayMode = "PC" Then
        popup.FontSize = largeFONT
        previewWin.FontSize = largeFONT
    Else
50    End If

```

```

    previewWin.FontSize = mediumFONT
    popup.FontSize = smallFONT
End If
5      rItem(0).BackColor = itemCOLOR
      selector.FillColor = highlightCOLOR
      displayList.FillColor = backgroundCOLOR
      previewWin.BackColor = backgroundCOLOR
      locator.FillColor = backgroundCOLOR
itemBox(0).BackColor = itemCOLOR
10     leftArrow(0).BackColor = itemCOLOR
      rightArrow(0).BackColor = itemCOLOR
      shpSlot.BorderColor = slotCOLOR
      'size the objects to the screen
      SizeAForm Me, DispTop, DispHeight, DispLeft, DispWidth
15     Me.Scale (0, 0)-(1000, 1000)
      SizeAControl locator, T - GAP, H + GAP, locL - GAP, locW + 2 * GAP
      SizeAControl shpSlot, T, H, locL + reducedEXTRA, locW - 2 * reducedEXTRA
      SizeAControl displayList, T - GAP, H + GAP, dispL, dispW
      SizeAControl popup, dispW / 2, 4 * locW, dispW / 2, 4 * locW
20     CPlace 1, previewWin, displayList
      locator.ZOrder
      shpSlot.ZOrder
      rItem(0).ZOrder
      itemRoom = H / MAXDISPLAY
      SizeAControl itemBox(0), T + (.5 * GAP), itemRoom - GAP, dispL + EXTRA, dispW -
25     2 * EXTRA
      SizeAControl patch(0), 50, (6.8 * itemBox(0).Height), (12.3 * itemBox(0).Width),
(7 * itemBox(0).Height)
      If displayMode = "TV" Then
        patch(0).Left = 8.08 * itemBox(0).Width
        patch(0).Height = 3.7 * itemBox(0).Height
30     End If
      SizeAControl leftArrow(0), T + (.5 * GAP), itemRoom - GAP, dispL, EXTRA
      SizeAControl rightArrow(0), T + (.5 * GAP), itemRoom - GAP, dispL + dispW -
EXTRA, EXTRA
35     SizeAControl selector, T, itemRoom + GAP, dispL, dispW
      selector.ZOrder
      For i = 1 To MAXDISPLAY
        'Load itemBox(i) 'Now created at design time--fixed number (6)
        itemBox(i).Visible = False
        CCopy itemBox(0), itemBox(i)
        patch(i).Visible = False
40     CPlace 0, patch(i), patch(0)
        itemBox(i).Top = itemBox(0).Top + (i - 1) * itemRoom
        Load leftArrow(i)
        leftArrow(i).Top = itemBox(i).Top
        Load rightArrow(i)
        rightArrow(i).Top = itemBox(i).Top
45     Next i

      'load the list data and set up the display
      sameFilter = False
      sameView = False
50     loadData

```

```

    Form_Activate
    sameFilter = True
End Sub

5      Function ItemString () As String
        'set msg to be used in info bar
        Dim msg As String

10     If Me Is TVlist Then
            msg = Format(filterData("Title")) & " on "
            msg = msg & StationString(filterData("Station")) & ", "
            msg = msg & TimeString(filterData("Start")) & " to "
            msg = msg & TimeString(filterData("Finish"))
        ElseIf Me Is MOVlist Then
            msg = Format(filterData("Title"))
            msg = msg & ", " & Format(filterData("Year"))
        ElseIf Me Is SHOPlist Then
            Select Case browsing
                Case "stuff"
                    msg = Format(filterData("name")) & " - $" & Format(filterData("price"))
                End Select
            End If
            ItemString = msg
        End Function

25      Sub LoadData ()
        Dim refSnap As snapshot
        Dim refDate

        'load in the database as a snapshot
        If Me Is TVlist Then
            startTime = fakeToday + fakeTime
            Set DB = OpenDatabase(TVDB)
            Set refSnap = DB.CreateSnapshot("Reference")
            refSnap.FindFirst "Name = 'Date'"
            refDate = DateValue(refSnap("Data"))
            Set allData = DB.CreateSnapshot("Programs")
            'filter for time would really happen at activate
            TS = (startTime - refDate) * 48
            allData.Filter = Overlap(TS, TS)
            Set allData = allData.CreateSnapshot()
        ElseIf Me Is MCVlist Then
            Set DB = OpenDatabase(MVDB)
            Set allData = DB.CreateSnapshot("Movies")
        ElseIf Me Is SHOPlist Then
            Set DB = OpenDatabase(SPDB)
            Set itemData = DB.CreateSnapshot("Items")
            Set storeData = DB.CreateSnapshot("Stores")
            Set deptData = DB.CreateSnapshot("Departments")
            Set stuffData = DB.CreateSnapshot("Stuff")
        End If
    End Sub

50      Sub RedoDisplay ()

```

```

'set the captions in the itemBoxes to correspond to items in locator
'reposition locator and selector, update info box

5      Dim last As Integer
      Dim i As Integer
      Dim Index As Integer 'index of rItem

10     If MAXITEM = 0 Then Exit Sub
      'figure first item location
      filterData.Bookmark = marker(locSelected)

Index = locStart(locSelected)
For i = 1 To MAXDISPLAY
    If filterData.EOF Then
        'hide empty itemBox
        itemBox(i).Caption = ""
        itemBox(i).Visible = False
        leftArrow(i).Visible = False
        rightArrow(i).Visible = False
    Else
        whichrItem(i) = Index 'so we can highlight the correct rItem (reduced
item)
        If colorField <> "" Then itemBox(i).BackColor =
Color(filterData(colorField) Mod 9)
        itemBox(i).Caption = filterData(captionField)
        If Not inPreview Then itemBox(i).Visible = True
        If Me Is TVlist And Not inPreview Then
            'show arrows to reflect program length
            If filterData("StartTS") < TS Then
                leftArrow(i).BackColor = itemBox(i).BackColor
                leftArrow(i).Visible = True
            Else
                leftArrow(i).Visible = False
            End If
            If filterData("FinishTS") > TS Then
                rightArrow(i).BackColor = itemBox(i).BackColor
                rightArrow(i).Visible = True
            Else
                rightArrow(i).Visible = False
            End If
            'show color patch for subcategory
            patch(i).FillColor = Color(filterData("Category") Mod 9)
            patch(i).Visible = True
        End If
        last = i
        Index = Index + 1
        filterData.MoveNext
    End If
Next i

'Do not allow blank to be selected
If itemSelected > last Then
    itemSelected = last
End If

```

```

    'fix the rest of the display
    displayList.Height = H + 2 * GAP - (H / MAXDISPLAY * (MAXDISPLAY - last))
5   'display list shrinks when fewer than MAXDISPLAY items displayed
    selector.Top = itemBox(itemSelected).Top - GAP 'behind current itemBox
    locator.Top = T + rowOffset * (locStart(locSelected) - 1)
    locator.Height = last * rowOffset + rItem(0).Height - rowOffset 'height shrinks
when displayList shrinks
    rItem(0).Top = rItem(whichrItem(itemSelected)).Top
10  SetItemInfo
End Sub

Sub SetItemInfo ()
    'display current item's info in info bar
15  Dim i As Integer '# of records away from bookmark we need to go
    Dim msg As String

    'find selected record
    filterData.Bookmark = marker(locSelected)
20  i = itemSelected
    While (i > 1)
        filterData.MoveNext
        i = i - 1
    Wend
    'Put info in the info bar
25  SetInfo ItemString(), (itemBox(itemSelected).BackColor)
    'update preview window if needed
    If inPreview Then ShowPreview
End Sub

30  Sub ShowPreview_()
    'Display the video, still, or text preview
    ' of the item selected
    Dim msg As String
    If Me Is MOVlist Then
        msg = filterData("Plot")
35  ElseIf Me Is TVlist Then
        msg = filterData(captionField) & Chr(13)
        msg = msg & StationString(filterData("Station")) & Chr(13)
        msg = msg & CategoryString((filterData("Type")), (filterData("Category")))
    Else
        msg = "This would be a video, still, or textual preview of ''"
40  msg = msg & filterData(captionField)
        msg = msg & ""
    End If
    previewWin.Visible = False
    previewWin.Caption = msg
45  CPlace 0, previewWin, displayList
    previewWin.Visible = True
End Sub

50  Sub tmrBlink_Timer ()
    BlinkControl.Visible = Not BlinkControl.Visible
End Sub

```

```

' ===== MESSAGE form code =====
' This form is used by Help and some lists to display information,
' temporarily covering up the current form.
5 Option Explicit

Const GAP = 500

10 Sub Form_Activate ()
    textArea.Caption = userMsg
End Sub

Sub Form_KeyDown (KeyCode As Integer, Shift As Integer)
    Select Case KeyCode
15    Case Else
        returnCode = KeyCode
        Me.Hide
    End Select
End Sub

20 Sub Form_Load ()
    'set colors and fonts
    Me.BackColor = itemCOLOR
    textArea.BackColor = itemCOLOR
    textArea.FontSize = largeFONT
25    'set sizes
    SizeAForm Me, DispTop, DispHeight, DispLeft, DispWidth
    SizeAControl textArea, GAP, DispHeight - 2 * GAP, GAP, DispWidth - 2 * GAP
    'initialize
    textArea.Caption = ""
30 End Sub

' ===== ROLODEX form code =====
' This form shows the main menu and filter menus.
' Unimplemented: Have filter button color correspond to type/category color
Option Explicit

35 Dim BlinkControl As Control 'pointer to blinking highlight
Dim parent As Integer      'number of parent card
Dim current As Integer     'number of current card

40 'spécial cards
'note: these must be updated each time the number of filter cards in the card
datafile changes
Const filterCARD = 1      'TV filter menu
Const mfilterCARD = 68    'movie filter menu
Const homeCARD = 96       'main menu
45 Dim lastCard As Integer 'holds number of regular card while in filter

Const MAXTITLE = 3 'WARNING: A change in MAXTITLE requires a change in code for
LoadGraphics
Const CARDSHIFT = 2.5 'for card display--amount change in card placement
Const MAXROWS = 3 'for card display--number of rows of buttons
Const MAXCOLS = 3 'for card display--number of columns of buttons on a card
50

```

```

Const MAXCARD = 9 'max number of cards that can be displayed on screen
Const MAXITEM = 9 'max number of buttons on a card

5   'action codes: tell what action to take for a button choice
'actions greater than actNEXT need additional input
Const actCOMING = 2
Const actNOW = 3
Const actNEXT = 5
10  Const actALPHASHOP = 6
Const actFILTER = 7
Const actALPHATV = 8
Const actALPHAMOV = 9
Const actDOMAIN = 10
Const actLATER = 11
15  Const actWEEK = 12
Const actWKEND = 13
Const actSCHED = 14
Const shortTVVIEW = 30
Const shortMVVIEW = 31
20  Const shortSPVIEW = 32
Const shortTVNOW = 35
Const shortTVFAV = 36
Const shortMVFAV = 37
Const shortSPFAV = 38
Const actMOVIE = 40
25  Const actSTORE = 50
Const actDEPT = 52
Const actMORE = 60
Const actNONE = 65
'for development only
Const actKEYS = 71
30  Const actTABS = 72

Sub Animate (direct As String, cardNo As Integer)
'Animate opening another card, backing up, or selecting a button
35  Dim index As Integer
    Dim depth As Integer

    DoEvents 'do not interrupt another animation
    depth = Cards(current).level
    Select Case direct
        Case "Back"
40        If Cards(current).parent > 0 Then
            CCopy sspCard(depth), sspCont
            sspCont.Visible = True
            Zoom 10, sspCont, sspItem(Cards(current).self)
            DisplayCard (Cards(current).parent)
            sspCont.Visible = False
        End If
        Case "Next"
            index = Cards(current).selected
            If index > 0 Then
                CCopy sspItem(index), sspCont
50            sspCont.Visible = True

```

```

    sspCont.BackColor = sspCard(0).BackColor
    Zoom 10, sspCont, sspCard(depth)
    DisplayCard cardNo
    sspCont.Visible = False
5   End If
    Case "Select"
        index = Cards(current).selected
        If index > 0 Then
            CCopy ssplItem(index), sspCont
        sspCont.Visible = True
        sspCont.BackColor = sspCard(0).BackColor
        SizeACControl sspCard(0), 0, 500, 0, 500 'size of whole form
        Zoom 10, sspCont, sspCard(0)
        End If
10   End Select
15   End Sub

Sub BlinkStart (C As Control, vis)
'enable blinking object
    Set BlinkControl = C
20   BlinkControl.Visible = vis
    tmrBlink.Enabled = True
    End Sub

Sub BlinkStop (vis)
'stop blinking object, leaving visibility as vis
    tmrBlink.Enabled = False
    If BlinkControl Is Nothing Then
        'do nothing
    Else
        BlinkControl.Visible = vis
30   End If
        Set BlinkControl = Nothing
    End Sub

Sub ButtonAction ()
'perform action associated with selected button
    Dim button As Integer
    Dim cardNo As Integer
    Dim msg As String

40   button = Cards(current).selected 'item number of selected button on parent card
    cardNo = Cards(current).item(button) 'card number of selected button
    If button < 1 Then Exit Sub

        Select Case Cards(cardNo).actionCode
        Case actNONE
            'an inactive button
            SetInfo "This option is not yet available.", greyCOLOR
45   Case actNEXT
            'display the next card
            Animate "Next", Cards(current).item(button)
        Case actDOMAIN
            'change current domain before going to the next card
50

```

```

currDomain = Val(Cards(cardNo).actionData)
SetStatus Cards(cardNo).name, greyCOLOR
Animate "Next", Cards(current).item(button)
5 Case actMORE
  'show more choices on same topic (currently same as actNEXT)
  Animate "Next", Cards(current).item(button)
Case actCOMING
  'show schedule of what's coming up on TV
  Animate "Select", 0
10 sameFilter = False
  Set views(currDomain) = frmComing
  returnCode = SHOWVIEW
  Me.Hide
Case actNOW
  'show what's on TV now
  currView(currDomain) = "TV 6:30pm : " 'obviously, this would be the current
15 time
  Animate "Select", 0
  sameFilter = False
  sameView = True
20 Set views(currDomain) = listFrm(currDomain)
  returnCode = SHOWVIEW
  Me.Hide
Case actLATER
  'show what's on TV for a later day
25  'currently non-functional
  Animate "Select", 0
  sameFilter = False
  Set views(currDomain) = frmFriday
  returnCode = SHOWVIEW
  Me.Hide
30 Case actWEEK
  'show TV schedule for weekdays
  Animate "Select", 0
  sameFilter = False
  Set views(currDomain) = frmWkday
35  returnCode = SHOWVIEW
  Me.Hide
Case actWKEND
  'show TV schedule for weekend
  'currently non-functional
  Animate "Select", 0
40  sameFilter = False
  Set views(currDomain) = frmWkend
  returnCode = SHOWVIEW
  Me.Hide
Case actSCHED
  'show TV schedule
  'currently non-functional
  Animate "Select", 0
45  sameFilter = False
  Set views(currDomain) = frmSched
  returnCode = SHOWVIEW
  Me.Hide
50

```

```

Case actALPHASHOP
    'get a string from user, search for items beginning with user string
    'note: this would probably be very different
5     Animate "Select", 0
    SetStatus "Shopping, " & Cards(cardNo).name, greyCOLOR
    msg = Cards(cardNo).actionData
    SetInfo msg, YELLOW
    Wait frmAlpha
    If returnCode <> BACK And userString <> "" Then
10      sameFilter = False
        filters(currDomain) = "item"
        Set views(currDomain) = listFrm(currDomain)
        returnCode = SHOWVIEW
        Me.Hide
    End If
15      Case actALPHATV
        'allow user to select a show title
        Animate "Select", 0
        SetStatus "TV, " & Cards(cardNo).name, greyCOLOR
        returnCode = PICK
20      Me.Hide
    Case actALPHAMOV
        'This is not hooked up to work, but would probably be
        ' a lot like actALPHTV
        'Animate "Select", 0
25      Case actFILTER
        'send a new filter to a TV view
        filters(currDomain) = Cards(cardNo).actionData
        currFilter(currDomain) = Cards(cardNo).infotext
        sameFilter = False
        sameView = True
30      returnCode = SHOWVIEW
        Me.Hide
    Case actMOVIE
        'show a movie list
        Animate "Select", 0
35      If current > homeCARD Then
            'the view (a filter) is changing
            currView(currDomain) = Cards(cardNo).infotext
            viewFilter = Cards(cardNo).actionData
            sameView = False
            sameFilter = False
40      Else
            'the category is changing
            currFilter(currDomain) = ":" & Cards(cardNo).infotext
            filters(currDomain) = Cards(cardNo).actionData
            sameView = True
            sameFilter = False
45      End If
        Set views(currDomain) = listFrm(currDomain)
        returnCode = SHOWVIEW
        Me.Hide
    Case actSTORE
        'show a list of stores
50

```

```

Animate "Select", 0
SetInfo "Choose a store:", TURQUOISE
SetStatus "Shopping", greyCOLOR
5   sameFilter = False
filters(currDomain) = "store"
Set views(currDomain) = listFrm(currDomain)
returnCode = SHOWVIEW
Me.Hide

Case actDEPT
10  'show products from a department
Animate "Select", 0
SetStatus "Shopping, " & Cards(cardNo).infotext, greyCOLOR
sameFilter = False
filters(currDomain) = "dept"
15  userString = Cards(cardNo).name
Set views(currDomain) = listFrm(currDomain)
returnCode = SHOWVIEW
Me.Hide

Case shortTVVIEW
20  'Show last TV schedule or list
Animate "Select", 0
currDomain = TV
If views(currDomain) Is Nothing Then
    Set views(currDomain) = frmComing
End If
25  sameFilter = True
returnCode = SHOWVIEW
Me.Hide

Case shortMVVIEW
30  'Show lat movie list
Animate "Select", 0
currDomain = MOVIE
If views(currDomain) Is Nothing Then
    Set views(currDomain) = listFrm(currDomain)
End If
sameFilter = True
35  returnCode = SHOWVIEW
Me.Hide

Case shortSPVIEW
40  'Show last shopping view
Animate "Select", 0
currDomain = SHOP
If views(currDomain) Is Nothing Then
    Set views(currDomain) = listFrm(currDomain)
End If
sameFilter = True
returnCode = SHOWVIEW
45  Me.Hide

Case shortTVNOW
46  'show all TV shows on now
currFilter(currDomain) = "All Categories"
currView(currDomain) = "TV 6:30pm : " 'obviously, this would be the current
time
50  Animate "Select", 0

```

```

currDomain = TV
filters(currDomain) = ""
sameFilter = False
sameView = True
Set views(currDomain) = listFrm(currDomain)
returnCode = SHOWVIEW
Me.Hide
5 Case actKEYS
    'Only for development, wouldn't stay
    SetKeys Cards(cardNo).actionData
    SetStatus Cards(cardNo).infotext, itemCOLOR
    current = homeCARD
    DisplayCard current
10 Case actTABS
    'only for development
    ToggleTabs
15 Case Else
    MsgBox "Bad action code for card " & Cards(cardNo).name
    Stop
    End
20 End Select
End Sub

Sub ChangeSel (direct As String)
25 'do button navigation
    Dim n As Integer
    Dim last As Integer, Sel As Integer
    n = Cards(current).NItems
    last = Cards(current).selected
    If last = 0 Then Exit Sub

30    If direct = "Right" Then
        'move right with wrap around
        If last = n Then
            Sel = 1
        Else
            Sel = last + 1
        End If
    ElseIf direct = "Left" Then
        'move left with wrap around
        If last = 1 Then
            Sel = n
        Else
            Sel = last - 1
        End If
    ElseIf direct = "Up" Then
        'move up, no wrap around
        If last > MAXCOLS Then
            Sel = last - MAXCOLS
        Else
            Sel = last
        End If
    ElseIf direct = "Down" Then
        'move down, no wrap around
40
45
50
55

```

```

    If last <= n - MAXCOLS Then
        Sel = last + MAXCOLS
    Else
        Sel = last
    End If
Else
    MsgBox "Bad Direction"
End
End If

10
Cards(current).selected = Sel
UpdateSel
End Sub

15
Sub DisplayCard (index)
'takes care of displaying menu on screen
Dim depth As Integer      'number of visible cards
Dim i As Integer           'counter
Dim ancestor As Integer   'card numbers

20
current = index
parent = Cards(current).parent
depth = Cards(current).level

    'hide cards after (in front of) current
25
For i = MAXCARD To depth + 1 Step -1
    sspTitle(i).Visible = False
    sspCard(i).Visible = False
Next i

    'make sure previous tab names are correct and visible
30
ancestor = current
For i = depth - 1 To 1 Step -1
    ancestor = Cards(ancestor).parent
    sspTitle(i).Caption = Cards(ancestor).name
    sspCard(i).Visible = True
    sspTitle(i).Visible = True
35
Next i

    'show current card
    sspTitle(depth).Caption = Cards(current).name
    sspCard(depth).Visible = True
    sspTitle(depth).Visible = True

    'show buttons on current card
    DisplayItems
End Sub

40
45
Sub DisplayItems ()
'displays buttons on a card
    Dim Area As SSSPanel
    Dim i As Integer
    Dim Dx, Dy, x, Y, w, h
    Dim NItems As Integer
50

```

```

NItems = Cards(current).NItems

5   Set Area = sspCard(Cards(current).level)'this is a pointer, not a copy
'calculate size of button
Dx = Area.Width * .9 / MAXCOLUMNS
Dy = Area.Height * .9 / MAXROWS
w = Dx * .9
If w > 30 Then w = 30
h = Dy * .9
If h > 20 Then h = 20

10  sspBlinkBG.Visible = False
sspBlinkBG.ZOrder 0      'bring to front
'place and show each button
For i = 1 To NItems
    sspItem(i).Width = w
    sspItem(i).Height = h
    sspItem(i).Caption = Cards(Cards(current).item(i)).name
    If Cards(Cards(current).item(i)).actionCode = actNONE Then
        'turn inactive buttons grey
        sspItem(i).BackColor = greyCOLOR
    Else
        sspItem(i).BackColor = itemCOLOR
    End If
25  x = Area.Left + .05 * Area.Width + ((i - 1) Mod MAXCOLUMNS + .5) * Dx
    Y = Area.Top + .05 * Area.Height + (Int((i - 1) / MAXCOLUMNS) + .5) * Dy
    CenterItem sspItem(i), x, Y
    sspItem(i).ZOrder 0
    sspItem(i).Visible = True
Next i
'make blinker bigger than buttons
CPlace 2, sspBlinkBG, sspItem(1)

30  'hide unused buttons
For i = NItems + 1 To MAXITEM
    sspItem(i).Visible = False
Next i
UpdateSel
End Sub

Sub Form_Activate ()
40  'check for a return code from another form
    sspCont.Visible = False
    Select Case returnCode
    Case BACK
        If current < homeCARD Then current = lastCard
        SetStatus "Use arrows and select or use keypad.", greyCOLOR
45  DisplayCard current
        UpdateSel
    Case SHORTCUT
        current = homeCARD
        SetStatus "Use arrows and select or use keypad.", greyCOLOR
50  DisplayCard current

```

```

      UpdateSel
5     Case FILTER
        SetStatus "Use arrows and select or use keypad.", greyCOLOR
        If current < homeCARD Then
          DisplayCard current
        Else
          lastCard = current
          Select Case currDomain
10    Case TV
            DisplayCard filterCARD
          Case MOVIE
            DisplayCard mfilterCARD
          Case SHOP
            DisplayCard current
          End Select
15    End If
      UpdateSel
      Case COMING
        ' to get from TV list view to schedule view
        Cards(current).selected = 2
20    sameFilter = False
        Set views(currDomain) = frmComing
        returnCode = SHOWVIEW
        Me.Hide
        End Select
25    End Sub

Sub Form_KeyDown (KeyCode As Integer, Shift As Integer)
  Dim index As Integer
  Dim n As Integer

30    Select Case KeyCode
    Case B_BACK
      'Go up in menu hierarchy
      Animate "Back", 0
    Case B_HELP
      InvokeHelp
    Case B_PREVIEW
      userStation = 1
      userStart = fakeTime
      returnCode = TOTV
      Me.Hide
40    Case B_SELECT
      'Do button action
      ButtonAction
    Case B_RIGHT
      ChangeSel ("Right")
45    Case B_LEFT
      ChangeSel ("Left")
    Case B_UP
      ChangeSel ("Up")
    Case B_DOWN
      ChangeSel ("Down")
50    Case B_PAGEUP

```

```

Case B_PAGEDOWN
'use numeric key pad to choose a button directly, without navigation
5 Case B_1
    If Cards(current).NItems > 0 Then
        Cards(current).selected = 1
        UpdateSel
        ButtonAction
    End If
10 Case B_2
    If Cards(current).NItems > 1 Then
        Cards(current).selected = 2
        UpdateSel
        ButtonAction
    End If
15 Case B_3
    If Cards(current).NItems > 2 Then
        Cards(current).selected = 3
        UpdateSel
        ButtonAction
    End If
20 Case B_4
    If Cards(current).NItems > 3 Then
        Cards(current).selected = 4
        UpdateSel
        ButtonAction
    End If
25 Case B_5
    If Cards(current).NItems > 4 Then
        Cards(current).selected = 5
        UpdateSel
        ButtonAction
    End If
30 Case B_6
    If Cards(current).NItems > 5 Then
        Cards(current).selected = 6
        UpdateSel
        ButtonAction
    End If
35 Case B_7
    If Cards(current).NItems > 6 Then
        Cards(current).selected = 7
        UpdateSel
        ButtonAction
    End If
40 Case B_8
    If Cards(current).NItems > 7 Then
        Cards(current).selected = 8
        UpdateSel
        ButtonAction
    End If
45 Case B_9
    If Cards(current).NItems > 8 Then
        Cards(current).selected = 9
        UpdateSel
50

```

```

      ButtonAction
    End If
5   Case B_0
      current = homeCARD
      DisplayCard current
    Case Asc("Q")
      End
    End Select
  End Sub

10  Sub Form_Load ()
    'set fonts and colors
    sspCard(0).BackColor = backgroundCOLOR
    sspTitle(0).BackColor = backgroundCOLOR
    15   sspItem(0).BackColor = itemCOLOR
    sspBlinkBG.BackColor = highlightCOLOR
    sspItem(0).FontSize = mediumFONT
    sspCard(0).FontSize = mediumFONT
    sspTitle(0).FontSize = mediumFONT
    Me.BackColor = formCOLOR
    'fit into display area
    SizeAForm Me, dispTop, dispHeight, dispLeft, dispWidth
    Me.Scale (0, 0)-(100, 100)
    'set global return code to default
    returnCode = BACK
25   'read in menu hierarchy for rclodex
    PopulateCards
    'load graphical objects
    LoadGraphics
    'set current card on screen
    DisplayCard homeCARD
30   End Sub

35  Sub LoadGraphics ()
    Dim i As Integer 'counter
    Dim tabHeight
    'load buttons
    For i = 1 To MAXITEM
      Load sspItem(i)
    Next i

40   'shape prototype card
    sspCard(0).Top = sspItem(0).Height
    sspCard(0).Height = 100 - CARDSHIFT - sspCard(0).Top
    sspCard(0).Left = 2 * CARDSHIFT
    sspCard(0).Width = 100 - 4 * CARDSHIFT
    'shape prototype tab
    45   sspTitle(0).AutoSize = False
    sspTitle(0).Width = sspCard(0).Width / MAXTITLE - CARDSHIFT
    'load and shape cards and tabs
    For i = 1 To MAXCARD
      Load sspCard(i)
      sspCard(i).Height = sspCard(i - 1).Height - CARDSHIFT
50

```

```

    sspCard(i).Top = sspCard(i - 1).Top + CARDSHIFT
    sspCard(i).ZOrder
    Load sspTitle(i)
    sspTitle(i).Top = sspCard(i).Top - sspTitle(0).Height + 2
    Select Case (i Mod MAXTITLE)
      'note: these cases are not flexible for different MAXTITLE
      Case 1
        sspTitle(i).Left = sspCard(i).Left
      Case 2
        sspTitle(i).Left = sspCard(i).Left + sspCard(i).Width * 2 -
    sspTitle(i).Width / 2
      Case 0
        sspTitle(i).Left = sspCard(i).Left + sspCard(i).Width - sspTitle(i).Width
    End Select
    sspTitle(i).ZOrder
  15  Next i
End Sub

Sub PopulateCards ()
  'This subroutine reads in the card data from the
  'CARDFILE file defined as a constant. The cards
  'will be numbered 1 to the number of lines (cards)
  'in the file. All special cards should come before
  'the home card (by convention), and are named as
  'constants in the declarations. Each card record
  'should have a level (integer), item selected (integer),
  'a name (string), an info string (string), and
  'an action code (integer). If the action code is greater
  'than actNEXT, one additional input (variant type) is read
  'for the card.
  20  Dim last As Integer, parent As Integer
    Dim selected As Integer
    Dim index As Integer, itemNo As Integer
    Dim level, title, text, action
    Open CARDFILE For Input As #1

  35  'make dummy parent for top level
    index = 0
    Cards(index).name = "root"
    Cards(index).level = 0
    Cards(index).NItems = 0
    While Not EOF(1)
      40  last = index
      index = index + 1
      Input #1, level, selected, title, text, action
      Cards(index).level = level
      Cards(index).selected = selected
      Cards(index).name = title
      Cards(index).infotext = text
      Cards(index).actionCode = action
      If action > actNEXT Then
        Input #1, action
        Cards(index).actionData = action
      End If
  50

```

```

Cards(index).NItems = 0 'initialize number of items
If Cards(index).level = Cards(last).level + 1 Then
    'Child of last
    parent = last
ElseIf Cards(index).level <= Cards(last).level Then
    'Sibling or cousin, back up to find parent
    Do While (Cards(index).level < Cards(last).level)
        'Find last sibling
        last = Cards(last).parent
    Loop
    parent = Cards(last).parent
Else 'Skipped a level, text file is incorrect
    MsgBox "Bad level in text file."
    Stop
End
15 End If
Cards(index).parent = parent
'Add self to parent's list of items
itemNo = Cards(parent).NItems + 1
Cards(parent).NItems = itemNo
20 Cards(parent).item(itemNo) = index
Cards(index).self = itemNo
Wend
Cards(0).NItems = 1
Close #1
25 End Sub

Sub tmrBlink_Timer ()
    BlinkControl.Visible = Not BlinkControl.Visible
End Sub

30 Sub ToggleTabs ()
    'toggles offset of tab placement; development only
    Dim i As Integer
    Static offset
    If offset = 3.5 Then
        offset = 2
    Else
        offset = 3.5
    End If
    For i = 1 To 9
        sspTitle(i).Top = sspCard(i).Top - sspTitle(0).Height + offset
    Next i
End Sub

40 Sub UpdateSel ()
    'put blinking highlight in correct location, update info bar
    Dim i As Integer
    Dim x, y
    Dim S As SSPanel
    Dim text As String
    Dim color

    45 BlinkStop False 'turn blinking off
    50

```

```

    i = Cards(current).selected
    If i > 0 Then 'something is selected
        Set S = sspItem(i) 'S is pointer to button
        'find center of button
        x = S.Left + S.Width / 2
        Y = S.Top + S.Height / 2
        'put blinker behind button
        CenterItem sspBlinkBG, x, Y
        'resume blinking
        BlinkStart sspBlinkBG, True
    End If
    text = Cards(Cards(current).item(Cards(current).selected)).infotext
    color = sspItem(Cards(current).selected).BackColor
    SetInfo text, color
10   End Sub
15

Sub Zoom (n As Integer, C As Control, Dest As Control)
    'animates control C changing size to control Dest
    Dim i As Integer, j As Integer
    Dim dl, dw, dt, dh
20   dl = (Dest.Left - C.Left) / n
    dw = (Dest.Width - C.Width) / n
    dt = (Dest.Top - C.Top) / n
    dh = (Dest.Height - C.Height) / n
    C.ZOrder
    C.AutoSize = False
    For i = 1 To n
        C.Move C.Left + dl, C.Top + dt, C.Width + dw, C.Height + dh
        C.Refresh
    Next i
    End Sub
30

'===== SELECT form code =====
'This form is another attempt at alphabetic input that allows only valid input.
' It relies on the TV titles database which has two tables. The reference table is
used first
35   ' and contains a count of all items starting with each letter of the alphabet or
with a
    ' symbol or number. The user is first presented with a list of possible starting
letters
    ' (each item in the first on-screen list may have several letters in it). Once a
starting
40   ' letter is chosen, a snapshot is made of matching entries from the table of titles.
    ' Each list the user sees has only valid choices for the next letter, or full titles
if
    ' a particular title is distinguished from all others by the letters chosen so far.
    ' The best way to understand is to see the form in action before reading the code.
    'The code could easily be modified to work with other data such as lists of movies.
etc.
45   'note: the non-proportional font used in the itemBoxes is Courier New
Option Explicit
Dim DB As database 'the full database

50   Dim list(1000) As String 'the list of selection strings

```

```

Dim leaf(1000) As Integer 'true if nth item is a leaf, false otherwise
Dim listEnd As Integer 'number of last element in list
Dim currPrefix As String 'the letters chosen so far
Dim initialList As Integer 'boolean 'true if this list has multiple letters per item
5 Dim BlinkControl As Control 'not used, currently no blinking object
Dim itemSelected As Integer 'from 1 to MAXDISPLAY
Dim locSelected As Integer 'from 1 to MAXLOC
Dim rowOffset 'difference between tops of two consecutive reduced items

10 'database
Dim allData As snapshot
Dim filterData As snapshot
Dim marker(100) As String 'bookmarks of each MAXDISPLAY items
Dim locStart(100) As Integer'rItem index for start of locator

15 'display parameters
Const MAXDISPLAY = 6 'Number of items in close up
Dim MAXITEM As Integer 'Number of items in whole list
Dim MAXLOC As Integer 'Number of locator positions
Dim whichrItem(MAXDISPLAY) As Integer 'which rItems are in the current display
20 Const GAP = 10 'space around lists
Const EXTRA = 70 'room for longer programs
Const reducedEXTRA = 20 'room for longer programs in reduced rep
Const T = 50
Const H = 1000 - 2 * T
25 Const locL = 30 'for reduced list
Const locW = 100
Const dispL = locW + 2 * locL 'for display list
Const dispW = 1000 - dispL - locL

Sub BlinkStart (C As Control, vis)
30   Set BlinkControl = C
     BlinkControl.Visible = vis
     tmrBlink.Enabled = True
   End Sub

35 Sub BlinkStop (vis)
     tmrBlink.Enabled = False
     If BlinkControl Is Nothing Then 'do nothing
     Else
40       BlinkControl.Visible = True
     End If
     Set BlinkControl = Nothing
   End Sub

Sub ChangeLoc (direct As String)
45   'page up or down with the locator
     Select Case direct
     Case "Up"
       If locSelected > 1 Then
         locSelected = locSelected - 1
         RedoDisplay
       End If
     Case "Down"
50

```

```

    If locSelected < MAXLOC Then
        locSelected = locSelected + 1
        RedoDisplay
5      End If
    End Select
End Sub

Sub ChangeSel (direct As String)
    'Perform list navigation
10     Select Case direct
        Case "Up"
            If itemSelected > 1 Then
                'move up within items currently displayed
                itemSelected = itemSelected - 1
15                selector.Top = itemBox(itemSelected).Top - GAP
                rItem(0).Top = locator.Top + rowOffset * (itemSelected - 1)
                SetItemInfo
            ElseIf locSelected > 1 Then
                'display previous section of the list
                itemSelected = MAXDISPLAY
20                locSelected = locSelected - 1
                RedoDisplay
            End If
        Case "Down"
            If itemSelected < MAXDISPLAY Then
                'move down within items currently displayed
                'do not move to select an empty item
                If (locSelected - 1) * MAXDISPLAY + itemSelected < MAXITEM Then
                    itemSelected = itemSelected + 1
                    selector.Top = itemBox(itemSelected).Top - GAP
30                    rItem(0).Top = locator.Top + rowOffset * (itemSelected - 1)
                    SetItemInfo
                End If
            ElseIf locSelected < MAXLOC Then
                'display next section of list
                itemSelected = 1
35                locSelected = locSelected + 1
                RedoDisplay
            End If
        End Select
    End Sub

40     Sub DoSelect ()
        'finish with leaf value or create a new list based on user's choice of prefix
        Dim index As Integer
        Dim count As Integer
        Dim i As Integer
45        Dim nextChar As String
        Dim looking As Integer 'boolean
        Dim title As String

        index = locStart(locSelected) + itemSelected - 1  'index in list of item
selected
50        If leaf(index) Then

```

```

'selection made; show next view
title = removeAmpersand(list(index))
filterData.FindFirst "SelectTitle = "" & title & """
5 If filterData.NoMatch Then
    Do 'prompt for different title until found
    'note: this should never happen, it's only in the list if it's in the
    database
        title = InputBox(title & " not found. Enter new title:", title)
        filterData.FindFirst "SelectTitle = "" & title & """
10    Loop Until Not filterData.NoMatch
    End If
    userString = filterData("FullTitle")
    Set views(TV) = frmWeek
    sameFilter = False
15    returnCode = SHOWVIEW
    Me.Hide
Else
    'indicate to user that something is happening
    itemBox(itemSelected).BackColor = greyCOLOR
20    SetInfo "Loading data, please wait...", greyCOLOR
    DoEvents
    i = Len(list(index))
    currPrefix = ""
    If initialList Then
        currPrefix = list(index)
25    Else
        'remove underline formatting (&) from prefix
        If i > 2 Then currPrefix = Left(list(index), i - 2)
        currPrefix = currPrefix & Right(list(index), 1)
    End If
30    SetStatus "TV Titles starting with " & currPrefix, greyCOLOR
    'construct new list
    If initialList Then
        'list items are special, not prefixes
        If index = 1 Then
            'Symbol or Number selected
35        initialList = False
            filterData.Filter = "SelectTitle < 'A'"
            currPrefix = ""
        Else
            'a list of letters selected
            listEnd = 0
40        For i = 1 To Len(currPrefix)
            'strip out the letters (ignore commas) to make a new list
            If Mid(currPrefix, i, 1) >= "A" Then
                listEnd = listEnd + 1
                list(listEnd) = "&" & Mid(currPrefix, i, 1)
45            leaf(i) = False
            End If
            Next i
        End If
    Else
        'refilter data to match the new prefix
50        filterData.Filter = "SelectTitle like '" & currPrefix & "*"

```

```

End If

5   'data assumed to be already sorted
If Not initialList Then
  'still need to create new list from data
  Set filterData = filterData.CreateSnapshot()
  filterData.MoveFirst
  listEnd = 0
10  For i = Asc(" ") To Asc("Z") 'space, punctuation, and letters
    'note: should be fixed up by not trying every single one, go straight to
    next db item's char
    count = 0: looking = True
    While Not filterData.EOF And looking
      nextChar = Mid(filterData("SelectTitle"), Len(currPrefix) + 1,
15    1)
      If nextChar = Chr(i) Or nextChar = LCase(Chr(i)) Then
        count = count + 1
        filterData.MoveNext
      Else
        looking = False
20      End If
      Wend
      Select Case count
      Case 0 'do not add to list
      Case 1 'make a leaf entry
25      filterData.MovePrevious
      listEnd = listEnd + 1
      list(listEnd) = fixAmpersand((filterData("SelectTitle")))
      leaf(listEnd) = True
      filterData.MoveNext
      Case Else 'make a non-leaf entry
        filterData.MovePrevious
        listEnd = listEnd + 1
        list(listEnd) = currPrefix & "&" & Chr(i) 'underline new char
        'note: underlining is just one mechanism for emphasizing what is
30      different
        leaf(listEnd) = False
        filterData.MoveNext
      End Select
      Next i
      If filterData.RecordCount <= MAXDISPLAY Then
        'redo the list to have just leaves in it, if they all fit in one
40    display
        listEnd = 0
        filterData.MoveFirst
        While Not filterData.EOF
          listEnd = listEnd + 1
          list(listEnd) = fixAmpersand((filterData("SelectTitle")))
45        leaf(listEnd) = True
          filterData.MoveNext
        Wend
        End If
      End If
50

```

```

    'display the newly created list
    itemBox(itemSelected).BackColor = itemCOLOR 'restore itemBox color
    initialList = False
    If listEnd > 1 Then
        NewList
    Else
        'automatically select item if only one in list
        locSelected = 1
        itemSelected = 1
    DoSelect
    End If
End If
End Sub

15 Sub Form_Activate ()
    'always begin with initial list
    LoadData
    NewList
End Sub

20 Sub Form_KeyDown (KeyCode As Integer, Shift As Integer)
    Select Case KeyCode
    Case Asc("Q")
        End
    Case B_BACK
        'note: do we want ability to back up one level from a particular choice in
        'the list?
        ' Could have B_BACK go back one list then back to menu after another press.
        returnCode = BACK
        Me.Hide
    Case B_HELP
        InvokeHelp
    Case B_PREVIEW
    Case B_SELECT
        DoSelect
    Case B_UP
        ChangeSel ("Up")
    Case B_DOWN
        ChangeSel ("Down")
    Case B_RIGHT
    Case B_LEFT
    Case B_PAGEUP
        ChangeLoc ("Up")
    Case B_PAGEDOWN
        ChangeLoc ("Down")
    Case B_FILTER
    Case B_G
        returnCode = SHORTCUT
        Me.Hide
    End Select
End Sub

45 Sub Form_Load ()
    Dim i As Integer 'counter

```

```

Dim itemRoom

    'set colors and fonts
5     itemBox(0).FontSize = largeFONT
    rightArrow(0).FontSize = largeFONT
    rItem(0).BackColor = itemCOLOR
    selector.FillColor = highlightCOLOR
    displayList.FillColor = backgroundCOLOR
    locator.FillColor = backgroundCOLOR
10    itemBox(0).BackColor = itemCOLOR
    rightArrow(0).BackColor = itemCOLOR
    shpSlot.BorderColor = slotCOLOR
    'size and place the objects to the screen
    SizeAForm Me, DispTop, DispHeight, DispLeft, DispWidth
15    Me.Scale (0, 0)-(1000, 1000)
    SizeAControl locator, T - GAP, H + GAP, locL - GAP, locW + 2 * GAP
    SizeAControl shpSlot, T, H, locL + reducedEXTRA, locW - 2 * reducedEXTRA
    SizeAControl displayList, T - GAP, H + GAP, dispL, dispW
    locator.ZOrder
    shpSlot.ZOrder
20    rItem(0).ZOrder
    itemRoom = H / MAXDISPLAY
    SizeAControl itemBox(0), T + (.5 * GAP), itemRoom - GAP, dispL + EXTRA, dispW -
2 * EXTRA
    SizeAControl leftArrow(0), T + (.5 * GAP), itemRoom - GAP, dispL, EXTRA
25    SizeAControl rightArrow(0), T + (.5 * GAP), itemRoom - GAP, dispL + dispW -
EXTRA, EXTRA
    SizeAControl selector, T, itemRoom + GAP, dispL, dispW
    selector.ZOrder
    For i = 1 To MAXDISPLAY
        Load itemBox(i)
30        itemBox(i).Visible = False
        itemBox(i).Top = itemBox(0).Top + (i - 1) * itemRoom
        Load rightArrow(i)
        rightArrow(i).Top = itemBox(i).Top
    Next i
35    End Sub

Sub loadData ()
    Dim refSnap As snapshot
    Const MAXTOGETHER = MAXDISPLAY 'number of letter allowed in one itemBox
    Dim together
40

    'fill initial selection list
    listEnd = 0
    Set DB = OpenDatabase(TVTitles)
    Set allData = DB.CreateSnapshot("Titles")
45

    'create initial list
    Set refSnap = DB.CreateSnapshot("Reference")
    refSnap.MoveFirst
    together = MAXTOGETHER 'indicate need for new item
    While Not refSnap.EOF
50        Select Case refSnap("Number")

```

```

Case 0
    'do not add to list
Case 1
    'make a leaf entry
    listEnd = listEnd + 1
    allData.FindFirst "SelectTitle like " & refSnap("Letter") & "*"
    list(listEnd) = allData("SelectTitle")
    leaf(listEnd) = True
    together = MAXTOGETHER
10   Case Else
        If refSnap("Letter") = "#" Then
            listEnd = listEnd + 1
            list(listEnd) = "Symbol or Number"
            together = MAXTOGETHER
15       'note: DoSelect relies on this entry being the first list item
        Else
            If together >= MAXTOGETHER Then
                listEnd = listEnd + 1
                list(listEnd) = refSnap("Letter")
                together = 1
20       Else
                list(listEnd) = list(listEnd) & ", " & refSnap("Letter")
                together = together + 1
            End If
25       End If
            leaf(listEnd) = False
        End Select
        refSnap.MoveNext
        Wend
30   Set filterData = allData
        initialList = True
    End Sub

Sub NewList ()
    'remakes the display for a new list
    'note: should itemSelected be initialized to something other than 1?
35   Dim i As Integer 'counter
    Dim section As Integer 'count the number of locator locations
    Dim msg As String

        'clear captions
    For i = 1 To MAXDISPLAY
        itemBox(i).Caption = ""
    Next i

    For i = 1 To MAXITEM
        Unload rItem(i)
    Next i

    MAXITEM = listEnd 'number of items in list

    'load the reduced item shapes and size relative to MAXITEM
    rowOffset = (H - rItem(0).Height) / MAXITEM
50   If rowOffset > rItem(0).Height + GAP Then rowOffset = rItem(0).Height + GAP

```

```

5      rItem(0).Visible = False
rItem(0).Top = T
rItem(0).Left = locL + reducedEXTRA
rItem(0).Width = locW - 2 * reducedEXTRA
rItem(0).BackColor = itemCOLOR
filterData.MoveFirst
'size and place the item shapes
'and set section bookmarks
10     section = 0      'number of locator locations
For i = 1 To MAXITEM
    Load rItem(i)
    rItem(i).Top = T + (i - 1) * rowOffset
    If ((i - 1) Mod MAXDISPLAY) = 0 Then
        'begin a new locator location
15      section = section + 1
        locStart(section) = i
    End If
    If Not leaf(i) Then
        rItem(i).Width = rItem(i).Width + reducedEXTRA
20      End If
    rItem(i).ZOrder
    rItem(i).Visible = True
Next i
MAXLOC = section
locStart(section + 1) = MAXITEM + 1
25

'set length of minselector
'use rItem(0) as mini selector
rItem(0).Left = locL - GAP
rItem(0).Width = locW + 2 * GAP

30      'initialize selector and locator
itemSelected = 1
locSelected = 1
rItem(0).BackColor = highlightCOLOR

35      'set the captions in the itemBoxes
RedoDisplay
End Sub

Sub RedoDisplay ()
    'set the captions in the itemBoxes to correspond to items in locator
    'reposition locator, selector and set item info in info box
40

    Dim last As Integer 'number of last item in display
    Dim i As Integer 'counter
    Dim index As Integer 'index of item in list
45

    index = locStart(locSelected)
    For i = 1 To MAXDISPLAY
        If index > MAXITEM Then
            'hide empty itemBox
            itemBox(i).Caption = ""
50      itemBox(i).Visible = False

```

```

    rightArrow(i).Visible = False
Else
    itemBox(i).Caption = list(index)
    If Not leaf(index) Then
        'show right arrow and put in all caps
        rightArrow(i).Visible = True
        itemBox(i).Caption = UCASE(list(index))
    Else
        rightArrow(i).Visible = False
    End If
    itemBox(i).Visible = True
    last = i  'remember last valid selection
    index = index + 1
End If
15 Next i

'Do not allow blank to be selected
If itemSelected > last Then
    itemSelected = last
End If
20

'fix the rest of the display
displayList.Height = H + 2 * GAP - (H / MAXDISPLAY * (MAXDISPLAY - last))
selector.Top = itemBox(itemSelected).Top - GAP
locator.Top = T + rowOffset * (locStart(locSelected) - 1)
locator.Height = last * rowOffset + rItem(0).Height - rowOffset
rItem(0).Top = locator.Top + rowOffset * (itemSelected - 1)
rItem(0).Visible = True
SetItemInfo
End Sub

30 Function removeAmpersand (oldText As String) As String
'for each double ampersand, remove one of them
    Dim text As String
    Dim newText As String
    Dim i As Integer
35
    text = oldText
    newText = ""
    While InStr(text, "&&")
        i = InStr(text, "&&")
        newText = newText & Left(text, i)
        text = Right(text, Len(text) - (i + 1))
    Wend
    removeAmpersand = newText & text
End Function

40
45 Sub SetItemInfo ()
'put the relevant info for current item into info box
    Dim msg As String
    Dim index As Integer
    Dim F As snapshot
50
    If Me.Visible Then

```

```

index = locStart(locSelected) + itemSelected - 1
If leaf(index) Then
    'get full title from data
    Set F = filterData
    F.FindFirst "SelectTitle = "" & list(index) & """
    msg = F("FullTitle")
Else
    msg = "Titles beginning with '" & list(index) & "'"
End If
SetInfo msg, (itemBox(itemSelected).BackColor)
End If
End Sub

Sub tmrBlink_Timer ()
    BlinkControl.Visible = Not BlinkControl.Visible
End Sub

' ===== START form code =====
'This startup form allows the developer to choose display mode
' (either for PC, TV, or mini PC for making screen prints)
' then starts the actual program by calling Main
Option Explicit

Sub Form_Load ()
    returnCode = STARTUP
End Sub

Sub miniButton_Click ()
    displayMode = "mini"
    Unload Me
    Main
End Sub

Sub PCbutton_Click ()
    displayMode = "PC"
    Unload Me
    Main
End Sub

Sub TVbutton_Click ()
    displayMode = "TV"
    Unload Me
    Main
End Sub

' ===== TV form code =====
'This form pretends to show a TV program or record it, if it is not currently on
Option Explicit

Const GAP = 700

Sub Form_Activate ()
    Dim msg As String

```

```

Dim DB As database
Dim Programs As table
Dim startTime
Dim refSnap As snapshot
Dim refDate
Dim startTS, finishTS, nowTS

5      Set DB = OpenDatabase(TVDB)
       Set refSnap = DB.CreateSnapshot("Reference")
       refSnap.FindFirst "Name = 'Date'"
       refDate = DateValue(refSnap("Data"))
       Set Programs = DB.OpenTable("Programs")
       Programs.Index = "ID"
       Programs.Seek "=", userStation, userStart
       'note: ought to check that userStation is valid
10     If Programs.NoMatch Then
             'simulate showing whatever is currently on userStation
             nowTS = DateDiff("n", refDate, fakeToday + fakeTime) \ 30
             Set refSnap = Programs.CreateSnapshot()
             refSnap.FindFirst "Station = " & Str(userStation)
             refSnap.FindNext "FinishTS > " & Str(nowTS)
             msg = "You are watching "
             msg = msg & Chr(13) & Format(refSnap("Title"))
             msg = msg & " on " & StationString(refSnap("Station"))
             msg = msg & Chr(13) & Format(refSnap("Start"), "h:mm AM/PM")
             msg = msg & " to " & Format(refSnap("Finish"), "h:mm AM/PM")
20     Else
             'decide if the program is on, record if it's not
             startTS = DateDiff("n", refDate, Programs("Start")) \ 30
             finishTS = DateDiff("n", refDate, Programs("Finish")) \ 30
             nowTS = DateDiff("n", refDate, fakeToday - fakeTime) \ 30
             'nowTS would be calculated to work in real time
             If startTS <= nowTS And finishTS >= nowTS Then
                 msg = "You are watching "
             Else
                 msg = "The VCR is set to record "
             End If
30     msg = msg & Chr(13) & Format(Programs("Title"))
             msg = msg & " on " & StationString(Programs("Station"))
             msg = msg & Chr(13) & Format(Programs("Start"), "h:mm AM/PM")
             msg = msg & " to " & Format(Programs("Finish"), "h:mm AM/PM")
40     End If
             textArea.Caption = msg
         End Sub

Sub Form_KeyDown (KeyCode As Integer, Shift As Integer)
    Select Case KeyCode
        Case B_BACK
45            returnCode = LASTVIEW
            'note: this is not appropriate if we came from menu (rolodex)
            Me.Hide
        Case B_0
            returnCode = SHORTCUT
50            Me.Hide
    End Sub

```

```

Case Asc("Q")
End
Case Else
 5   returnCode = BACK
    Me.Hide
  End Select
End Sub

Sub Form_Load ()
 10  textArea.Caption = ""
    textArea.FontSize = largeFONT
    SizeAForm Me, 0, ScrHeight, 0, ScrWidth
    SizeAControl textArea, GAP, ScrHeight - 2 * GAP, GAP, ScrWidth - 2 * GAP
End Sub

15  ===== TV_GUIDE form code =====
'General remarks:
'  The Main procedure starts the ball rolling by showing the Frame, loading
'  all the forms, and then showing the rolodex menu. Control is transferred from form
'  to form through the use of the returnCode variable (see list of return codes in
20  'global declarations). The frmDex, for example, sets the returnCode to SHOWVIEW, and
'  hides itself. This causes frmFrame to become active. frmFrame looks at the
'  returnCode
'  and shows the current domain's view form. Communication between forms is done
'  through
25  ' a variety of variables, since a form's procedures are not accessible from outside.

Option Explicit
*****
' Global Declarations
*****
30  'database constants
Global Const CARDFILE = "c:\pctv\db\cards2.txt"
Global Const MVDB = "c:\pctv\db\plots.mdb"
Global Const SPDB = "c:\pctv\db\shopping.mdb"
Global Const TVDB = "c:\pctv\db\big.mdb"
35  Global Const TVTitles = "c:\pctv\db\titles.mdb"
Const CATDB = "c:\pctv\db\cats.mdb"
Dim typeTable As table  'TV type IDs
Dim catTable As table  'TV category IDs
Dim statTable As table 'station IDs
Global fakeToday 'keep the day constant
Global fakeTime 'keep the time constant
40  Global displayMode As String 'display set for "PC" or "TV" (affects size of fonts
and graphics)
Global newUser As Integer 'boolean 'when true, give extra helps

45  Global ScrWidth, ScrHeight
Global DispTop, DispHeight, DispLeft, DispWidth 'display area available to forms
inside the frame

'Colors
50  Global Const highlightCOLOR = &H8080FF  'redish
Global Const backgroundCOLOR = &H80FFFF  'yellow

```

```

Global Const itemCOLOR = &HFFFFC0      'light blue
Global Const formCOLOR = &HFF0000      'dark blue
Global Const whiteCOLOR = &H80000005  'white
Global Const greyCOLOR = &HC0C0C0      'grey
Global Const blackColor = &H0&          'black
Global Const slotCOLOR = &H80000005  'white
Global Const borderCOLOR = &HFF&        'red
Global Const divideCOLOR = &HFFFF&      'white
Global Color(10)  'array filled in Main

10   'font sizes
Global Const smallFONT = 13.8
Global Const mediumFONT = 18
Global Const largeFONT = 24

15   'domain constants
Global Const MOVIE = 0
Global Const TV = 1
Global Const SHOP = 2

20   'array of list forms
Global listFrm(3) As Form
Global TVlist As New frmList
Global MOVlist As New frmList
Global SHOPlist As New frmList

25   *****
'     Inter-Form Communication
*****
30   Global currDomain As Integer 'the current domain
Global filters(3) As String 'array of query strings for current domain filter
Global currFilter(3) As String 'text name of filter
Global currView(3) As String 'text name of current view (use mainly for lists which
change view title)
Global views(3) As Form 'array of current domain views (TV coming or TV schedule,
for instance)
Global viewFilter As String 'the database filter needed to obtain the appropriate
view
'note: used only for movies at this time, would probably be expanded to array
Global userString As String 'string chosen by user
Global userMsg 'message string to display to user
Global userStation 'a station selected by user
Global userStart 'a time chosen by user

40   Global sameFilter As Integer 'boolean 'true if need to refilter data
Global sameView As Integer 'boolean 'true if need to redo display

45   'return codes determine which action to take on re-activate of frmFrame or frmDex
Global returnCode As Integer
Global Const BACK = 0
Global Const TOTV = 1
Global Const LASTVIEW = 2
Global Const SHORTCUT = 3
Global Const DONE = 4

```

```

Global Const FILTER = 5
Global Const COMING = 6
Global Const SHOWVIEW = 9
Global Const ALPHA = 10
Global Const PICK = 11
Global Const STARTUP = 12

*****
10 Define Type Card
   for rolodex
*****
Global Const MAXITEM = 9  'max number of buttons on a card

15 'Represents one index card as viewed on screen
Type Card
   self As Integer  'item number of self on parent
   level As Integer 'number of cards away from root
   name As String   'text to appear on button/card
   infotext As String 'text for info bar
   actionCode As Integer 'code for action to take when chosen
20   actionData As String 'extra info needed for action
   parent As Integer 'number of parent card
   NItems As Integer 'number of buttons visible on card
   Item(MAXITEM) As Integer 'array of card pointers (one for each button on card)
   selected As Integer 'the number of the selected button
25 End Type

'Array of up to MAXCARDS index cards
Global Const MAXCARDS = 1000
Global Cards(MAXCARDS) As Card

30 *****
   Remote Buttons
*****
35 'assigned values in sub SetKeys
Global B_BACK
Global B_HELP
Global B_PREVIEW
Global B_UP
Global B_DOWN
Global B_LEFT
Global B_RIGHT
40 Global B_SELECT
Global B_PAGEUP
Global B_PAGEDOWN
Global B_1
Global B_2
Global B_3
45 Global B_4
Global B_5
Global B_6
Global B_7
Global B_8
50 Global B_9

```

```

Global B_0
Global B_FILTER

5      ****
'      COLORS
***** 
Global Const RED = &HFF&
Global Const ORANGE = &H80FF&
Global Const YELLOW = &HFFFF&
10     Global Const GREEN = &H80FF80
Global Const TURQUOISE = &HFFFFC0
Global Const BLUE = &HFF0000
Global Const VIOLET = &HFF00FF
Global Const WHITE = &FFFFFF
Global Const BLACK = &H0&
15     Global Const GREY = &HC0C0C0

***** 
'      CONSTANTS FROM VISUAL BASIC FILES
***** 

20     * From CONSTANT.TXT

'      Key Codes
Global Const KEY_LBUTTON = &H1
Global Const KEY_RBUTTON = &H2
Global Const KEY_CANCEL = &H3
25     Global Const KEY_MBUTTON = &H4      ' NOT contiguous with L & RBUTTON
Global Const KEY_BACK = &H8
Global Const KEY_TAB = &H9
Global Const KEY_CLEAR = &HC
30     Global Const KEY_RETURN = &HD
Global Const KEY_SHIFT = &H10
Global Const KEY_CONTROL = &H11
Global Const KEY_MENU = &H12
Global Const KEY_PAUSE = &H13
35     Global Const KEY_CAPITAL = &H14
Global Const KEY_ESCAPE = &H1B
Global Const KEY_SPACE = &H20
Global Const KEY_PRIOR = &H21
Global Const KEY_NEXT = &H22
Global Const KEY_END = &H23
40     Global Const KEY_HOME = &H24
Global Const KEY_LEFT = &H25
Global Const KEY_UP = &H26
Global Const KEY_RIGHT = &H27
Global Const KEY_DOWN = &H28
45     Global Const KEY_SELECT = &H29
Global Const KEY_PRINT = &H2A
Global Const KEY_EXECUTE = &H2B
Global Const KEY_SNAPSHOT = &H2C
Global Const KEY_INSERT = &H2D
Global Const KEY_DELETE = &H2E
50     Global Const KEY_HELP = &H2F

```

```

' KEY_A thru KEY_Z are the same as their ASCII equivalents: 'A' thru 'Z'
' KEY_0 thru KEY_9 are the same as their ASCII equivalents: '0' thru '9'

5   Global Const KEY_NUMPAD0 = &H60
    Global Const KEY_NUMPAD1 = &H61
    Global Const KEY_NUMPAD2 = &H62
    Global Const KEY_NUMPAD3 = &H63
    Global Const KEY_NUMPAD4 = &H64
10   Global Const KEY_NUMPAD5 = &H65
    Global Const KEY_NUMPAD6 = &H66
    Global Const KEY_NUMPAD7 = &H67
    Global Const KEY_NUMPAD8 = &H68
    Global Const KEY_NUMPAD9 = &H69
15   Global Const KEY_MULTIPLY = &H6A
    Global Const KEY_ADD = &H6B
    Global Const KEY_SEPARATOR = &H6C
    Global Const KEY_SUBTRACT = &H6D
    Global Const KEY_DECIMAL = &H6E
    Global Const KEY_DIVIDE = &H6F
20   Global Const KEY_F1 = &H70
    Global Const KEY_F2 = &H71
    Global Const KEY_F3 = &H72
    Global Const KEY_F4 = &H73
    Global Const KEY_F5 = &H74
25   Global Const KEY_F6 = &H75
    Global Const KEY_F7 = &H76
    Global Const KEY_F8 = &H77
    Global Const KEY_F9 = &H78
    Global Const KEY_F10 = &H79
    Global Const KEY_F11 = &H7A
30   Global Const KEY_F12 = &H7B
    Global Const KEY_F13 = &H7C
    Global Const KEY_F14 = &H7D
    Global Const KEY_F15 = &H7E
    Global Const KEY_F16 = &H7F
35   Global Const KEY_NUMLOCK = &H90

Function CategoryString (typeCode As Integer, catCode As Integer) As String
  'creates user-reable string for a TV program's category
40   Dim msg As String

    msg = "Category: "
    'look up type code
    typeTable.Index = "ID"
    typeTable.Seek "=", typeCode
45   If typeTable.NoMatch Then
      msg = msg & typeCode
    Else
      msg = msg & typeTable("Name")
    End If
50   msg = msg & ", " 'all on one line, replaced: Chr(13) & "Subcategory: "

```

```

'look up category code
catTable.Index = "ID"
catTable.Seek "=", catCode
5 If catTable.NoMatch Then
    msg = msg & catCode
Else
    msg = msg & catTable("Name")
End If
CategoryString = msg
10 End Function

Sub CCopy (Cfrom As Control, Cto As Control)
'copies attributes of CFrom control to CTo
    Cto.Caption = Cfrom.Caption
    Cto.BackColor = Cfrom.BackColor
15    Cto.Top = Cfrom.Top
    Cto.Height = Cfrom.Height
    Cto.Left = Cfrom.Left
    Cto.Width = Cfrom.Width
    Cto.FontSize = Cfrom.FontSize
20 End Sub

Sub CenterItem (Item As Control, x, y)
'centers a control around a point
    Item.Left = x - Item.Width / 2
    Item.Top = y - Item.Height / 2
25 End Sub

Sub CPlace (extra, Cfrom As Control, Cto As Control)
'place Cfrom in the same place as Cto, with difference extra
    Cfrom.Top = Cto.Top - extra
    Cfrom.Left = Cto.Left - extra
30    Cfrom.Height = Cto.Height + 2 * extra
    Cfrom.Width = Cto.Width + 2 * extra
End Sub

35 Function DayString (d, length As String) As String
'returns string for appropriate day of week based on date given
' and length specified
    Select Case Weekday(d)
        Case 1
            If length = "long" Then
                DayString = "Sunday"
40            Else
                DayString = "Sun"
            End If
        Case 2
            If length = "long" Then
                DayString = "Monday"
45            Else
                DayString = "Mon"
            End If
        Case 3
            If length = "long" Then

```

```

      DayString = "Tuesday"
    Else
      DayString = "Tue"
    End If
5   Case 4
      If length = "long" Then
        DayString = "Wednesday"
      Else
        DayString = "Wed"
10  End If
    Case 5
      If length = "long" Then
        DayString = "Thursday"
      Else
        DayString = "Thur"
15  End If
    Case 6
      If length = "long" Then
        DayString = "Friday"
      Else
        DayString = "Fri"
20  End If
    Case 7
      If length = "long" Then
        DayString = "Saturday"
      Else
        DayString = "Sat"
25  End If
  End Select
End Function

30  Function fixAmpersand (text As String)
  'put in a "&&" for every "&" so ampersand will print instead of format an underline
  Dim i As Integer
  Dim oldText As String
  Dim newText As String

35  newText = ""
  oldText = text
  While InStr(oldText, "&")
    i = InStr(oldText, "&")
    newText = Left(oldText, i - 1) & "&&"
40  oldText = Right(oldText, Len(cldText) - i)
  Wend
  fixAmpersand = newText & oldText
End Function

45  Sub InvokeHelp ()
  'add parameter for current location or give each form a local InvokeHelp
  'would be specialized for each view, probably not each button
  TellUser "Press Help (?) again for general help, or press any button on the
  remote for help with that button."
    Select Case returnCode
50  Case B_HELP

```

```

    TellUser "General Help: "
Case B_PREVIEW
    TellUser "Use the Preview button to see a video preview of the highlighted
5      selection."
Case B_BACK
    TellUser "Use the Back button to back up to the previous screen."
Case KEY_ESCAPE
    TellUser "Use the Shortcut key to get to the shortcut buttons."
Case B_SELECT
10     TellUser "Use the select button to choose a highlighted option."
Case Else
    TellUser "This help screen is not written yet."
End Select
End Sub

15 Sub Main ()
    Dim i As Integer
    Dim DB As database
    Set DB = OpenDatabase(CATDB)
    Set typeTable = DB.OpenTable("Type")
20     Set catTable = DB.OpenTable("Category")
    Set DB = OpenDatabase(TVDB)
    Set statTable = DB.OpenTable("Stations")
    SetKeys displayMode
    'set different list forms
    Set listFrm(TV) = TVlist
25     Set listFrm(MOVIE) = MOVlist
    Set listFrm(SHOP) = SHOPlist
    'set color array
    Color(0) = &HBFBFC00  'teal green
    Color(1) = &HFFFF80  'light blue
30     Color(2) = &HFFC0FF  'light pink
    Color(3) = &HFF80FF  'dark pink
    Color(4) = &H8GC0FF  'medium orange
    Color(5) = &HC0FFC0  'lightest green
    Color(6) = &HFF8080  'royal blue
35     Color(8) = &HFFC0C0  'lavendar
    Color(7) = &HC0C0&  'ochre
    'set date and time
    fakeToday = CVDate("6/12/94")
    fakeTime = CVDate("6:30 PM")

40 newUser = True

    'start up the forms
    frmFrame.Show
    DoEvents
45     'load all forms here
    Load frmDex
    Load frmAlpha
    Load frmTV
    Load frmMsg
    'Movie forms
    currDomain = MOVIE

```

```

viewFilter = "Year >= 1993"
currView(MOVIE) = "Recent Movies"
currFilter(MOVIE) = ": All Categories"
SetStatus "Movies", greyCOLOR
5 Load listFrm(MOVIE)
' Shopping forms
currDomain = SHOP
filters(SHOP) = ""
SetStatus "Shopping, compact disks", greyCOLOR
10 Load listFrm(SHOP)
'TV forms
currFilter(TV) = "Basketball"
currDomain = TV
filters(TV) = "Category = 39"
15 userString = "Nova"
Load frmWeek
Load listFrm(TV)
Load frmComing
Load frmWkday
Load frmSelect
20

'show main menu
SetStatus "Use arrows and select or use keypad.", greyCOLOR
frmDex.Show
End Sub
25

Function Overlap (beginTS, endTS) As String
'create query string to look for TV programs in the range between
' and including beginTS and endTS
Overlap = "(StartTS <= " & Str(endTS) & " And FinishTS >= " & Str(beginTS) & ")"
End Function
30

Sub SetInfo (text As String, Color)
'update the info box text and color
Dim s As SSPanel
Set s = frmFrame!sspInfo 'works as long as form is loaded
35 s.BackColor = Color
s.Caption = text
End Sub

Sub SetKeys (mode As String)
'Set the keymappings for keyboard or "remote"
40 B_1 = KEY_NUMPAD7
B_2 = KEY_NUMPAD8
B_3 = KEY_NUMPAD9
B_4 = KEY_NUMPAD4
B_5 = KEY_NUMPAD5
45 B_6 = KEY_NUMPAD6
B_7 = KEY_NUMPAD1
B_8 = KEY_NUMPAD2
B_9 = KEY_NUMPAD3
If mode = "TV" Then
    'use keypad for all buttons (except 1-9)
    50 B_BACK = KEY_SUBTRACT

```

```

B_HELP = 13 'I don't know what the name of this key is
B_PREVIEW = KEY_ADD
B_UP = Asc("8")
B_DOWN = Asc("2")
B_LEFT = Asc("4")
B_RIGHT = Asc("6")
B_SELECT = Asc("5")
B_PAGEUP = KEY_DIVIDE
B_PAGEDOWN = Asc("0")
B_0 = KEY_MULTIPLY
B_FILTER = KEY_RETURN
5      Else
         B_BACK = KEY_F1
         B_HELP = KEY_F3
10     B_PREVIEW = KEY_F2
         B_UP = KEY_UP
         B_DOWN = KEY_DOWN
         B_LEFT = KEY_LEFT
         B_RIGHT = KEY_RIGHT
20     B_SELECT = KEY_RETURN
         B_PAGEUP = KEY_PRIOR
         B_PAGEDOWN = KEY_NEXT
         B_0 = KEY_NUMPAD0
         B_FILTER = KEY_F4
25     End If
End Sub

Sub SetStatus (text As String, Color)
'update the status bar with new message
    Dim s As SSSPanel
30     Set s = frmFrame!sspStatus '(works as long as form is loaded)
     s.BackColor = Color
     s.Caption = text
End Sub

Sub SizeAControl (Item As Control, t, H, l, w)
'set the size attributes of a control
    Item.Top = t
    Item.Left = l
    Item.Height = H
    Item.Width = w
40     End Sub

Sub SizeAForm (frm As Form, t, H, l, w)
'set the size attributes of a form
    frm.Top = t
    frm.Left = l
45     frm.Height = H
     frm.Width = w
End Sub

Function StationString (s) As String
'looks up station number and returns station name as string
    statTable.Index = "ID"
50

```

```

statTable.Seek "=", s
If statTable.NoMatch Then
    MsgBox "illegal station ID " & s
    Stop
End If
StationString = statTable("Name")
End Function

Sub TellUser (message As String)
' displays message on screen until key is pressed
' probably would not be used
    userMsg = message
    Wait frmMsg
End Sub

Function TimeLabel (t) As String
' returns null string for times on half hour.
' returns hour 1..12 otherwise
    Dim s As String
    s = Format(t, "hh:mm AM/PM")
    If Mid(s, 4, 2) = "30" Then
        TimeLabel = ""
    Else
        s = Format(s, "h AM/PM")
        'strip off AM/PM
        TimeLabel = Left(s, Len(s) - 3)
    End If
End Function

Function TimeString (aDate) As String
'format a date as 12-hour time without AM/PM or leading zero
    Dim theTime As String
    theTime = Format(aDate, "hh:mm AM/PM")
    theTime = Left(theTime, 5) 'take just "hh:mm" part
    If Left(theTime, 1) = "0" Then
        theTime = Right(theTime, 4)
    End If
    TimeString = theTime
End Function

Sub Wait (F As Form)
'Allows one form to wait for another to hide itself
    F.Show
    While (F.Visible)
        DoEvents
    Wend
End Sub

' ===== WEEK form code =====
Option Explicit
'stacked channel' view to be used with TV search and
'possibly other minimal searches (would need modification in ApplyFilter)

Dim allData(8) As snapshot  'all data within time period

```

```

Dim filterData(8) As snapshot 'a snapshot for each day in the view
Dim NDays As Integer      'number of days in display
Dim NSlots As Integer      'number of time slots in display
Dim NProgs As Integer      'number of programs in display
5   Dim colorField As String 'the database field that determines item color
                                '(the field should contain an integer)
Dim inPreview As Integer 'boolean 'if true, preview should show
Dim refDate 'reference date for data time slots
Dim slotsPerDay As Integer 'number of slots allowed per day
10  Dim currDay 'number of current day
Dim dayWidth As Integer 'width of day labels
Dim lblHeight As Integer 'height of day labels
Dim infoHeight As Integer 'height of specialized info panel
Dim timeHeight 'height of time labels
15  Dim startTime 'beginning time for view
Dim TSBegin As Long 'first time slot of current day
Dim TSEnd As Long 'last time slot of current day
Dim TScurrent As Long 'time slot of current program

Sub ApplyFilter ()
20  'filter for a particular show by title in userString
    Dim i As Integer 'counter

    'create snapshot for each day
    For i = 1 To NDays
25    allData(i).Filter = "Title = " & userString & "))"
        Set filterData(i) = allData(i).CreateSnapshot()
        filterData(i).Sort = "StartTS"
        Set filterData(i) = filterData(i).CreateSnapshot()
    Next i
End Sub
30

Sub ChangeSel (d As String)
'perform view navigation
    Dim current 'as database marker
    Dim success As Integer 'boolean
    Dim s As Integer 'station number
35  Dim best
    Dim TS As Long 'time slot
    Dim F As snapshot
    Dim aDay As Integer
    Dim marker 'as bookmark
    Dim arrows As String

    'save values, initialize values
    current = filterData(currDay).Bookmark
    Set F = filterData(currDay)
    s = F("Station")
40  TS = TScurrent
    aDay = currDay
    success = False

    Select Case d
50    Case "Right"

```

```

'move to later time, same day
F.FindNext "StartTS > " & Str(TS)
success = Not F.NoMatch
5 If success Then
    'check if info arrows needed
    TS = F("StartTS")
    F.MoveNext
    If Not F.EOF Then
        If F("StartTS") = TS Then
            10 infoArrows "down"
        Else
            infoArrows "none"
        End If
    Else
        infoArrows "none"
    End If
    F.MovePrevious
    End If
Case "Left"
    'move to earlier time, same day
20 F.FindPrevious "StartTS < " & Str(TS)
success = Not F.NoMatch
    If success Then
        TS = F("StartTS")
        'go to top of column
25 F.FindFirst "StartTS = " & Str(TS)
        TS = F("StartTS")
        'check if info arrows needed
        F.MoveNext
        If Not F.EOF Then
            If F("StartTS") = TS Then
                30 infoArrows "down"
            Else
                infoArrows "none"
            End If
        Else
            infoArrows "none"
        End If
        F.MovePrevious
        End If
Case "Down"
    'move to later day, trying to keep close to previous time slot
40 If NProgs < 1 Then Exit Sub 'do nothing if all snapshots empty
    aDay = aDay + 1: TS = TS + 48
    While Not success And aDay <= NDays
        Set F = filterData(aDay)
        F.FindFirst "StartTS > " & Str(TS)
        45 If F.NoMatch Then
            'no prog to right, look left for any programs
            If Not F.EOF Then F.MoveLast
            If Not F.EOF Then
                success = True
                TS = F("StartTS")
            End If
50

```

```

    Else
        'save program to right, count time slots away, check left
        marker = F.Bookmark
        best = F("StartTS") - TS
        F.FindLast "StartTS <= " & Str(TS)
        If F.NoMatch Then
            'no prog to left, take program to right
            F.Bookmark = marker
            TS = TS + best
    10   Else
            'check distances from previous time slot
            If TS - F("StartTS") > best Then
                'right prog closest
                F.Bookmark = marker
                TS = TS + best
    15   Else
                'left prog closest
                TS = F("StartTS")
            End If
        End If
    20   'either way, we found a program
        success = True
    End If
    aDay = aDay + 1: TS = TS + 48
    Wend
    25   aDay = aDay - 1: TS = TS - 48
    If success Then
        'make sure to be at the top of a column
        F.FindFirst "StartTS = " & Str(TS)
        If F.NoMatch Then Stop 'how did we get a TS with no program in it?
        TS = F("StartTS")
    30   'check if info arrows needed
        F.MoveNext
        If Not F.EOF Then
            If F("StartTS") = TS Then
                infoArrows "down"
    35   Else
                infoArrows "none"
            End If
        Else
            infoArrows "none"
        End If
    40   F.MovePrevious
    End If
Case "Up"
    'move to earlier day, trying to keep close to previous time slot
    If NProgs < 1 Then Exit Sub 'do nothing if all snapshots empty
    aDay = aDay - 1: TS = TS - 48
    45   While Not success And aDay > 0
        Set F = filterData(aDay)
        F.FindFirst "StartTS > " & Str(TS)
        If F.NoMatch Then
            'no prog to right, look left
    50   If Not F.EOF Then F.MoveLast

```

```

      If Not F.EOF Then
          success = True
          TS = F("StartTS")
      End If
      5
      Else
          'save program to right, count time slots away, look left
          marker = F.Bookmark
          best = F("StartTS") - TS
          F.FindLast "StartTS <= " & Str(TS)
      10
          If F.NoMatch Then
              'no prog to left, take program to right
              F.Bookmark = marker
              TS = TS + best
          Else
              15
              'check distances
              If TS - F("StartTS") > best Then
                  'right prog closest
                  F.Bookmark = marker
                  TS = TS + best
              Else
                  20
                  'left prog closest
                  TS = F("StartTS")
              End If
          End If
          'either way, we found a program
          success = True
      25
      End If
      aDay = aDay - 1: TS = TS - 48
      Wend
      aDay = aDay + 1: TS = TS + 48
      If success Then
          30
          'make sure to be at the top of a column
          F.FindFirst "StartTS = " & Str(TS)
          If F.NoMatch Then Stop 'how did we get a TS with no program in it?
          TS = F("StartTS")
          'check if info arrows needed
          F.MoveNext
      35
          If Not F.EOF Then
              If F("StartTS") = TS Then
                  infoArrows "down"
              Else
                  40
                  infoArrows "none"
              End If
          Else
              infoArrows "none"
          End If
          F.MovePrevious
      45
      End If
      Case "Next"
          'find next program, same time and day
          F.MoveNext
          If Not F.EOF Then
              50
              'success means still in same time slot
              success = F("StartTS") = TS

```

```

End If
'set arrows
If success Then
    F.MoveNext
    arrows = "up"
    If Not F.EOF Then
        If F("StartTS") = TS Then arrows = "both"
    End If
    F.MovePrevious
    infoArrows arrows
10
    End If
Case "Prior"
    'find previous program, same time and day
    F.MovePrevious
    If Not F.BOF Then
        'success means still in same time slot
        success = F("StartTS") = TS
15
    End If
    'set arrows
    If success Then
        F.MovePrevious
        arrows = "down."
        If Not F.BOF Then
            If F("StartTS") = TS Then arrows = "both"
        End If
        F.MoveNext
20
        infoArrows arrows
    End If
Case "none"
    'stay at current program, update the arrows (used at startup)
    If Not F.EOF Then
        F.MoveNext
        arrows = "none"
        If Not F.EOF Then
            If F("StartTS") = TS Then arrows = "down"
        End If
        F.MovePrevious
35
        infoArrows arrows
    End If
End Select

If success Then
    'update
    TScurrent = F("StartTS")
    currDay = aDay
    DisplayProg
40
Else
    'restore database position
    filterData(currDay).Bookmark = current
45
End If
    'set begin and end time slots for current day
    TSBegin = DateDiff("n", refDate, (startTime - currDay - 1)) \ 30
    TSEnd = TSBegin + slotsPerDay - 1
50
End Sub

```

```

Sub DisplayProg ()
  'set info box with current program info and highlight position
  5    Dim F As snapshot
      Dim msg As String

      Set F = filterData(currDay)
      msg = StationString(F("Station")) & ":" & Format(F("Start"), "h:mm AM/PM")
      msg = msg & " to " & Format(F("Finish"), "h:mm AM/PM. ")
      msg = msg & Format(F("Title"))
      msg = msg & Chr(13) & "(episode info here)" & Format(F("Episode"))
      'note: current database does not contain episode information
      SetInfo msg, Color(F(colorField) Mod 9)

      15   shpProg(0).Visible = False
          selector.Visible = False
          Position shpProg(0), F("StartTS"), F("FinishTS")
          CPlace 0, selector, shpProg(0)
          shpProg(0).Visible = True
          selector.Visible = True
      20   End Sub

Sub DoPreview ()
  'Construct an appropriate preview message and display
  Dim msg As String

  25   msg = filterData(currDay)("Title")
      msg = msg & Chr(13) & "on " & StationString(filterData(currDay)("Station")) &
      Chr(13)
      msg = msg & CategoryString((filterData(currDay)("Type")),
      (filterData(currDay)("Category")))
  30   msg = msg & Chr(13) & DayString(Weekday(filterData(currDay)("Start")), "long")
      msg = msg & ", " & Format(filterData(currDay)("Start"), "mmm d, yy h:mm AM/PM")
      msg = msg & Chr(13) & " to " & Format(filterData(currDay)("Finish"), "h:mm
      AM/PM")

  35   popup.Caption = msg
      SizeAControl popup, (lblTime(1).top + 1.5 * lblTime(1).Height), 12,
      (lblDay(1).Width), 45
      popup.Visible = True
      inPreview = True
  40   End Sub

Sub DoSelect ()
  'set data for selection and go to TV
  userStation = filterData(currDay)("Station")
  userStart = filterData(currDay)("Start")
  returnCode = TOTV
  45   Me.Hide
  End Sub

Sub DrawProg (duplicates As Integer, index As Integer)
  'draw a program shape in display, marking it if there are duplicates at the'
  identical time slot
  50

```

```

'shpProg(0) should be at the desired location
Dim above, below, side, wide
Const GAP = .3

5      above = shpProg(0).top
below = shpProg(0).Height
side = shpProg(0).Left
wide = shpProg(0).Width
ForeColor = blackCOLOR  'line color, thin black outline
10     FillStyle = 0 'solid
drawwidth = 1

    Select Case duplicates
Case 0
    'draw the program in the given color
15     fillColor = Color(index)
    Line (side, above)-(side + wide, above + below - .5 * GAP), , B
Case 1
    'draw the program in grey and mark it
    fillColor = greyCOLOR  'indicate duplicates (which may be of different
20     colors)
    Line (side, above)-(side + wide, above + below - .5 * GAP), , B
    'draw icon
    above = above + GAP
    side = side + GAP
    wide = 2 * GAP
25     drawwidth = 2
    Line (side, above)-(side + wide, above + wide)
    Line (side, above + wide)-(side + wide, above)
    Line (side, above + .5 * wide)-(side + wide, above + .5 * wide)
    Line (side + .5 * wide, above)-(side + .5 * wide, above + wide)
30     Case Else
        'no need to redraw duplicate marks
    End Select

End Sub

35     Sub Form_Activate ()
        Dim i As Integer 'counter
        Static saveFilter As String

        If saveFilter = userString Then sameFilter = True
40     saveFilter = userString
        SetStatus "This Week: " & userString, greyCOLOR

        'if not same form, erase and redraw the week schedule
        If Not sameFilter Then
            Me.Cls
45         SetInfo "Loading program information...", GREY
            shpProg(0).Visible = False
            selector.Visible = False
            infoArrows "none"
            DcEvents

```

50

55

```

        ApplyFilter
        MakeDisplay
        sameFilter = True
    End If
End Sub

Sub Form_KeyDown (KeyCode As Integer, Shift As Integer)
    Dim index As Integer
    Dim n As Integer
    Select Case KeyCode
        Case Asc("Q")
            End
        Case B_BACK
            returnCode = BACK
            Me.Hide
        Case B_HELP
            sameFilter = True
            InvokeHelp
        Case B_PREVIEW
            If inPreview Then
                inPreview = False
                popup.Visible = False
            Else
                inPreview = True
            End If
        Case B_RIGHT
            ChangeSel ("Right")
        Case B_LEFT
            ChangeSel ("Left")
        Case B_UP
            ChangeSel ("Up")
        Case B_DOWN
            ChangeSel ("Down")
        Case B_SELECT
            If Not filterData(currDay).EOF Then DoSelect
        Case B_PAGEDOWN
            ChangeSel ("Next")
        Case B_PAGEUP
            ChangeSel ("Prior")
        Case B_FILTER
            'go back to frmSelect to choose a new title
            returnCode = PICK
            Me.Hide
        Case B_0
            returnCode = SHORTCUT
            Me.Hide
    End Select
    If inPreview Then
        DoPreview
    Else
        popup.Visible = False
    End If
End Sub

```

50

55

```

Sub Form_Load ()
    Dim i As Integer

    5      'set form colors and fonts
    Me.BackColor = formCOLOR
    shpProg(0).BackColor = BorderColor
    lblDay(0).BackColor = backgroundCOLOR
    selector.BorderColor = BorderColor
    dayLine(0).BorderColor = divideCOLOR
    10     lblTime(0).ForeColor = slotCOLOR
    shpSlot(0).BorderColor = slotCOLOR
    infoPanel.FontSize = mediumFONT
    If displayMode = "TV" Then
        15     lblDay(0).FontSize = smallFONT
        lblTime(0).FontSize = smallFONT
        popup.FontSize = mediumFONT
    Else
        20     lblDay(0).FontSize = largeFONT
        lblTime(0).FontSize = largeFONT
        popup.FontSize = largeFONT
    End If
    'cover up the standard info box
    SizeAForm Me, 0, DispTop + DispHeight, DispLeft, dispWidth
    'set scale and size objects
    NDays = 7
    25     NSlots = 48
    dayWidth = 4
    lblHeight = 2
    infoHeight = 6
    If displayMode = "TV" Then
        30     upArrow.Left = 8950
        downArrow.Left = 8950
        timeHeight = 2
        downArrow.top = 650
        upArrow.top = 150
    Else
        35     timeHeight = 1.5
        downArrow.top = 1525
    End If
    Me.Scale (0, 0)-(NSlots * dayWidth, NDays * lblHeight + 2 * timeHeight +
    infoHeight)
    40     selector.BorderWidth = 1
    'place extended info panel
    SizeAControl infoPanel, 0, infoHeight, 0, (Me.ScaleWidth)
    infoPanel.Caption = ""
    infoPanel.Visible = True
    'place day labels along side
    45     SizeAControl lblDay(0), lblHeight + infoHeight, lblHeight, 0, dayWidth
    For i = 1 To NDays
        Load lblDay(i)
        50     lblDay(i).Caption = DayString(i, "short")
        lblDay(i).top = (i - 1) * lblHeight + infoHeight + 2 * timeHeight
        lblDay(i).Visible = True
    Next i

```

```

'put AM/PM label across top
SizeACControl lbiDay(0), infoHeight, timeHeight, dayWidth, NSlots
lbiDay(0).Caption = "AM" NOON PM"
5 lbiDay(0).Visible = True
'put time labels across top
SizeACControl lbiTime(0), (lbiDay(0).Height) + infoHeight, timeHeight, 0, 2
For i = 1 To NSlots \ 2
    Load lbiTime(i)
    lbiTime(i).Caption = TimeLabel(DateAdd("h", (i - 1), fakeTODAY))
    lbiTime(i).Left = 2 * i + 2
    lbiTime(i).Visible = True
10 Next i
NProgs = 0
sameFilter = False
15 InputData
Form_Activate
End Sub

Sub infoArrows (direct As String)
20 'show or hide arrows in info box indicating presence of more programs at identical
time
    Select Case direct
    Case "up"
        downArrow.Visible = False
        upArrow.Visible = True
25    Case "down"
        upArrow.Visible = False
        downArrow.Visible = True
    Case "both"
        upArrow.Visible = True
        downArrow.Visible = True
30    Case "none"
        upArrow.Visible = False
        downArrow.Visible = False
    End Select
End Sub

35 Sub InputData ()
'part of form_load
'opens the database and creates allData snapshots
40     Dim DB As database
     Dim RefSnap As snapshot
     Dim i As Integer

     Set DB = OpenDatabase(TVDB)

45     'get reference date and number of stations
     Set RefSnap = DB.CreateSnapshot("Reference")
     RefSnap.FindFirst "Name = 'Date'"
     refDate = DateValue(RefSnap("Data"))
     RefSnap.FindFirst "Name = 'NStations'"

50     Set allData(0) = DB.CreateSnapshot("Programs")

```

```

startTime = refDate
TSBegin = 0
TSEnd = TSBegin + 48 - 1
For i = 1 To 7
    allData(0).Filter = Overlap(TSBegin + 48 * (i - 1), TSEnd + 48 * (i - 1))
    Set allData(i) = allData(0).CreateSnapshot()
Next i
Set allData(0) = Nothing 'no longer need data all together
End Sub

Sub MakeDisplay ()
    'create schedule display on screen
    Dim i As Integer 'counter
    Dim d As Integer 'day
    Dim TSlast As Integer 'last time slot affected
    Dim F As snapshot 'convenience
    Dim offset As Integer 'used twice: dayline offset & number of programs sharing a
    time slot

    'draw horizontal day lines
    drawwidth = 2
    ForeColor = lblDay(0).BackColor
    offset = infoHeight + 2 * timeHeight
    For i = 0 To NDays
        Line (0, offset + i * lblHeight)-(52, offset + i * lblHeight)
    Next i

    'place program shapes
    offset = 0 'keep track of how full a particular time slot is
    colorField = "Category" 'note: should this be "Type" instead?
    For d = 1 To NDays
        currDay = d
        TSlast = -1
        Set F = filterData(d)
        If Not F.EOF Then
            F.MoveFirst
            Do While Not F.EOF
                If F("StartTS") = TSlast Then
                    offset = offset + 1
                    DrawProg offset, -1
                Else
                    offset = 0
                    Position shpProg(0), F("StartTS"), F("FinishTS")
                    DrawProg offset, F(colorField) Mod 9
                    TSlast = F("StartTS")
                End If
            F.MoveNext
            Loop
            F.MoveFirst
        End If
    Next d

    'initialize stuff

```

```

d = 1
currDay = i
While d <= NDays
    If filterData(d).EOF Then
        d = d + 1
    Else
        NProgs = 1 'just to make sure it is more than 0
        currDay = d
        d = NDays + 1
    End If
Wend
shpProg(0).ZOrder
selector.ZOrder
If Not filterData(currDay).EOF Then
    TScurrent = filterData(currDay)("StartTS")
    DisplayProg
    ChangeSel "none"
End If
End Sub

20 Sub Position (shape As Control, start, finish)
'position a program shape
    Dim leftTS
    Dim rightTS
    Const smallGAP = .1

25     'convert to time slot scale
    leftTS = start - 48 * (currDay - 1)
    rightTS = finish - 48 * (currDay - 1)
    'set left and width
    shape.Left = dayWidth + leftTS
    shape.Width = rightTS - leftTS + 1 - smallGAP
    'cut off at beginning of day
    If shape.Left < dayWidth Then
        shape.Width = shape.Width - (dayWidth - shape.Left)
        shape.Left = dayWidth
    End If
    'set top and height
    shape.Height = 2 - 2 * smallGAP
    shape.Top = lblDay(currDay).Top + smallGAP
End Sub

30 Sub SetInfo (msg As String, Color)
'override the global SetInfo to write to my own info panel
    infoPanel.BackColor = Color
    infoPanel.Caption = msg
End Sub

35 Sub WKDAY (msg As String, Color)
'override the global WKDAY to write to my own info panel
    infoPanel.BackColor = Color
    infoPanel.Caption = msg
End Sub

40 Sub SetInfo (msg As String, Color)
'override the global SetInfo to write to my own info panel
    infoPanel.BackColor = Color
    infoPanel.Caption = msg
End Sub

45 Sub WKDAY (msg As String, Color)
'override the global WKDAY to write to my own info panel
    infoPanel.BackColor = Color
    infoPanel.Caption = msg
End Sub

50 Dim allData(8) As snapshot 'all data within time period

```

```

Dim filterData(0) As snapshot 'a snapshot for each day in the view
Dim NDays As Integer          'number of days in display
Dim NSlots As Integer         'number of time slots in display
5   Dim NProgs As Integer       'number of programs in display
Dim NStation As Integer        'number of stations in display
Dim MaxStation As Integer     'total number of stations in database
Dim colorField As String      'the database field that determines item color
                                '(the field should contain an integer)
Dim inPreview As Integer      'boolean 'true if preview should show
10  Const sideGap = .05 'space at beginning and end of program
    Const topGAP = 4 'space btwn time label and first program shape
    Dim refDate 'reference date for data time slots
    Const lblHEIGHT = 40 'height of day and time labels (in 500 scale)
    Const MINProgWidth = .2 'minimum width of a program shape as fraction of slot
15  Dim slotsPerDay As Integer 'number of slots allowed per day
    Dim currDay As Integer     'number of current day

    Dim startTime 'start day and time of display
    Dim TSBegin As Long        'first time slot
    Dim TSEnd As Long          'last time slot
20  Dim TSCurrent As Long      'current time slot
    Dim rowOffset 'distance between (tops of) rows in the schedule

Sub ApplyFilter ()
'create data set of onpy TV programs that fit into query string filters(TV)
25  'set number of stations and database field determining color
    Dim i As Integer 'counter

    If InStr(filters(TV), "Station") Then
        NStation = 10
        'note: need better mechanism for displaying favorite channels
30  colorField = "Type"
    Else
        NStation = MaxStation
        colorField = "Category"
    End If
    For i = 1 To NDays
        allData(i).Filter = filters(TV)
        Set filterData(i) = allData(i).CreateSnapshot()
    Next i
End Sub

40  Sub ChangeSel (d As String)
    Dim current, firstMatch 'as database markers
    Dim success As Integer 'boolean
    Dim s As Integer 'station
    Dim TS As Long 'time slot
45  Dim F As snapshot
    Dim aDay As Integer
    Dim best As Integer

    current = filterData(currDay).Bookmark
    Set F = filterData(currDay)
    s = F("Station")
50

```

```

TS = TScurrent
aDay = currDay
success = False

5   If d = "Right" Then
      'check to immediate right, same time slot
      F.MoveNext
      If Not F.EOF Then
          success = F("Station") = s And F("StartTS") = TS
      End If
      If Not success Then
          'check time slots to right
          shpSlot(TS - TSBegin + 1 + (currDay - 1) * slotsPerDay).FillStyle =
1'transparent
15    lbtTime(TS - TSBegin + 1 + (currDay - 1) * slotsPerDay).BackStyle =
0'transparent
          While aDay <= NDays And Not success
              While TS < TSEnd And Not success
                  TS = TS + 1
                  'check stations at and below current
20                F.FindFirst Overlap(TS, TS) & "And Station >= " & s
                  If F.NoMatch Then
                      'take the last station above current
                      F.FindLast Overlap(TS, TS) & "And Station < " & s
                      success = Not F.NoMatch
                  Else
                      'save this match and check if stations above are closer
                      success = True
                      best = F("Station") - s
                      firstMatch = F.Bookmark
                      'check previous
30                F.FindPrevious Overlap(TS, TS)
                      If F.NoMatch Then
                          'no previous match, stick with first match
                          F.Bookmark = firstMatch
                      Else
                          If s - F("Station") > best Then
                              'first match was closer
                              F.Bookmark = firstMatch
                          End If
                      End If
                  End If
40                Wend
                  If Not success Then
                      TSBegin = TSBegin + 48
                      TSEnd = TSBegin - slotsPerDay - 1
                      TS = TSBegin - 1
                      aDay = aDay + 1
                      Set F = filterData(aDay)
                  End If
                  Wend
              End If
45            ElseIf d = "Left" Then
              'check to immediate left, same time slot
50

```

```

F.MovePrevious
If Not F.BOF Then
    success = F("Station") = s And F("FinishTS") = TS
End If
If Not success Then
    'check previous time slots
    shpSlot(TS - TSBEGIN + 1 + (currDay - 1) * slotsPerDay).FillStyle =
    'transparent
    lbtTime(TS - TSBEGIN + 1 + (currDay - 1) * slotsPerDay).BackStyle =
    'transparent
    While aDay >= 1 And Not success           'for each day to left
        While TS > TSBEGIN And Not success   'look for previous slot this day
            TS = TS - 1
            F.FindFirst Overlap(TS, TS) & " And Station >= " & Str(s)
            If F.NoMatch Then
                'none with station less than current, look for first one down
                F.FindLast Overlap(TS, TS)
                success = Not F.NoMatch
            Else
                success = True
                'mark this one and check up
                firstMatch = F.Bookmark
                best = F("Station") - s
                F.FindPrevious Overlap(TS, TS)'will be less than current
                station
            If F.NoMatch Then
                'none lower, keep first match
                F.Bookmark = firstMatch
            Else
                If s - F("Station") > best Then
                    'first match was closer
                    F.Bookmark = firstMatch
                End If
            End If
        End If
    Wend
    If Not success Then                      'try previous day
        aDay = aDay - 1
        TSBEGIN = TSBEGIN - 48
        TSEnd = TSBEGIN + slotsPerDay - 1
        TS = TSEnd + 1
        Set F = filterData(aDay)
    End If
    Wend
End If
ElseIf d = "Down" Then
    'move down within time slot
    'note: should we have option to only stop at programs that _begin_ in current
    time slot?
    '           (with exception of first time slot in each day, of course)
    F.Bookmark = current
    F.FindNext "(" & Overlap(TS, TS) & " And Station <> " & Str(s) & ")"
    success = Not F.NoMatch
ElseIf d = "Up" Then

```

```

    'move down within time slot
    'note: should we have option to only stop at programs that _begin_ in current
    'time slot?
5     ' (with exception of first time slot in each day, of course)
     F.Bookmark = current
     F.FindPrevious "(" & Overlap(TS, TS) & " And Station <> " & Str(i) & ")"
     success = Not F.NoMatch
ElseIf d = "Top" Then
    F.FindFirst Overlap(TS, TS)
    success = Not F.NoMatch
ElseIf d = "Bottom" Then
    F.FindLast Overlap(TS, TS)
    success = Not F.NoMatch
End If

15   If success Then
        'update
        TScurrent = TS
        currDay = aDay
        DisplayProg
Else
20     'restore position in data
        filterData(currDay).Bookmark = current
End If
'restore other stuff
25   TSBegin = DateDiff("n", refDate, (startTime + currDay - 1)) \ 30
    TSEnd = TSBegin + slotsPerDay - 1
    shpSlot(TScurrent - TSBegin + 1 + (currDay - 1) * slotsPerDay).FillStyle =
    C'solid
    lblTime(TScurrent - TSBegin + 1 + (currDay - 1) * slotsPerDay).BackStyle =
    I'opaque
30   End Sub

Sub DisplayProg ()
    'highlight location of current program
    'put info for current program in info box
35   Dim F As snapshot
        Dim msg As String

        Set F = filterData(currDay)
        'highlight program
        shpProg(0).Visible = False
40   selector.Visible = False
        Position shpProg(0), F("Start"), F("Finish"), F("Station")
        CPlace 0, selector, shpProg(0)
        shpProg(0).Visible = True
        selector.Visible = True

45   'set message
        msg = StationString(F("Station")) & " - " & F("Title") & " "
        msg = msg & Format(F("Start"), "h:mm AM/PM")
        msg = msg & " to " & Format(F("Finish"), "h:mm AM/PM")
        'SetInfo msg, Color(F(colorField) Mod 9)
50   End Sub

```

```

Sub DoPreview ()
    'Construct an appropriate preview message and display
    Dim msg As String
    5

    msg = "Station: " & StationString(filterData(currDay)(("Station")))
    msg = msg & Chr(13) & "Title: " & filterData(currDay)(("Title")) & Chr(13)
    msg = msg & CategoryString((filterData(currDay)(("Type"))),
    (filterData(currDay)(("Category"))))
    10
    msg = msg & Chr(13) & "Time: " & Format(filterData(currDay)(("Start")), "mmmm d,yy
h:mm AM/PM")
    msg = msg & Chr(13) & "      to " & Format(filterData(currDay)(("Finish")), "h:mm
AM/PM")

    15
    'show popup with preview message
    popup.Caption = msg
    popup.Top = lblTime(1).Top + 2 * lblTime(1).Height
    popup.Left = 2
    popup.Width = slotsPerDay * NDays - 3
    popup.Visible = True
    20
    inPreview = True
End Sub

Sub DoSelect ()
    'set data for selection and go to TV
    userStation = filterData(currDay)(("Station"))
    25
    userStart = filterData(currDay)(("Start"))
    returnCode = TOTV
    Me.Hide
End Sub

30
Sub Form_Activate ()
    Dim i As Integer 'counter
    Static saveFilter As String

    If saveFilter = filters(currDomain) Then sameFilter = True
    35
    saveFilter = filters(currDomain)
    SetStatus "Evening TV: " & currFilter(TV), greyCOLOR
    'note: "Evening TV" label would be variable
    If inPreview Then
        popup.Visible = False
        inPreview = False
    40
    End If
    If newUser Then
        popup.Caption = "Press 'category' to change the kind of programs displayed."
        popup.Visible = True
        'note: ought to make popup go away on timer as well as button press
        45
        newUser = False
    End If

    If sameFilter Then
        'restore darkened time-slot
        If TScurrent > 0 Then
    50

```

```

      shpSlot(TScurrent - TSBEGIN - 1 + (currDay - 1) * slotsPerDay).FillStyle
= 0'solid
      lblTime(TScurrent - TSBEGIN - 1 + (currDay - 1) * slotsPerDay).BackStyle
= 1'solid
      End If
Else
      'unload old program shapes and redo display
      SetInfo "Loading program information...", GREY
      shpProg(0).Visible = False
      10    lblDay(0).Visible = False
      lblTime(0).Visible = False
      shpSlot(0).Visible = False
      selector.Visible = False
      For i = 1 To NProgs
          Unload shpProg(i)
      Next i
      ApplyFilter
      MakeDisplay
      sameFilter = True
      End If
20    End Sub

Sub Form_KeyDown (KeyCode As Integer, Shift As Integer)
    'note: always turn off the black slot before leaving, so it doesn't mess up
    later views
    Dim Index As Integer
    Dim n As Integer
    Select Case KeyCode
        Case Asc("Q")
            End
        Case B_BACK
            shpSlot(TScurrent - TSBEGIN - 1 + (currDay - 1) * slotsPerDay).FillStyle =
1'transparent
            lblTime(TScurrent - TSBEGIN - 1 + (currDay - 1) * slotsPerDay).BackStyle =
0'transparent
            returnCode = BACK
            Me.Hide
        Case B_HELP
            sameFilter = True
            InvokeHelp
        Case B_PREVIEW
            If inPreview Then
                popup.Visible = False
                inPreview = False
            Else
                inPreview = True
            End If
        Case B_RIGHT
            If Not filterData(currDay).EOF Then ChangeSel ("Right")
        Case B_LEFT
            If Not filterData(currDay).EOF Then ChangeSel ("Left")
        Case B_UP
            If Not filterData(currDay).EOF Then ChangeSel ("Up")
        Case B_DOWN
55

```

```

    If Not filterData(currDay).EOF Then ChangeSel ("Down")
    Case B_SELECT
        shpSlot(TScurrent - TSBegin + 1 + (currDay - 1) * slotsPerDay).FillStyle =
5      1'transparent
        lblTime(TScurrent - TSBegin + 1 + (currDay - 1) * slotsPerDay).BackStyle =
0'transparent
        If Not filterData(currDay).EOF Then DoSelect
    Case B_PAGEDOWN
        If Not filterData(currDay).EOF Then ChangeSel ("Bottom")
10     Case B_PAGEUP
        If Not filterData(currDay).EOF Then ChangeSel ("Top")
    Case B_FILTER
        shpSlot(TScurrent - TSBegin + 1 + (currDay - 1) * slotsPerDay).FillStyle =
1'transparent
15     lblTime(TScurrent - TSBegin + 1 + (currDay - 1) * slotsPerDay).BackStyle =
0'transparent
        returnCode = Filter
        Me.Hide
    Case B_0
        shpSlot(TScurrent - TSBegin + 1 + (currDay - 1) * slotsPerDay).FillStyle =
20     1'transparent
        lblTime(TScurrent - TSBegin + 1 + (currDay - 1) * slotsPerDay).BackStyle =
0'transparent
        returnCode = SHORTCUT
        Me.Hide
25     End Select
        If inPreview Then
            DoPreview
        Else
            popup.Visible = False
        End If
30     End Sub

Sub Form_Load ()
    Dim d As Integer, i As Integer, n As Integer 'counters
    Dim t 'as time
35     'set form colors and fonts
    Me.BackColor = formCOLOR
    shpProg(0).BackColor = BorderColor
    lblDay(0).BackColor = backgrounDCOLOR
    selector.BorderColor = BorderColor
    dayLine(0).BorderColor = divideCOLOR
40     lblTime(0).ForeColor = slotCOLOR
    shpSlt(0).BorderColor = slotCOLOR
    If displayMode = "TV" Then
        lblDay(0).FontSize = smallFONT
        lblTime(0).FontSize = smallFONT
        popup.FontSize = mediumFONT
45     Else
        lblDay(0).FontSize = largeFONT
        lblTime(0).FontSize = largeFONT
        popup.FontSize = largeFONT
    End If
50     'set scale and size objects

```

```

SizeAForm Me, DispTop, DispHeight, DispLeft, DispWidth
Me.Scale (0, 0)-(500, 500)
SizeAControl lblDay(0), 0, lblHEIGHT, 0, 500
SizeAControl lblTime(0), lblHEIGHT, lblHEIGHT, 0, 50
SizeAControl shpSlot(0), 2 * lblHEIGHT + .5 * topGAP, 500 - 2 * lblHEIGHT, 0, 50
SizeAControl popup, 250, 200, 250, 200
selector.BorderWidth = 1
dayLine(0).Y1 = 0
dayLine(0).Y2 = 500
10   'init variables
sameFilter = False
sameView = False
inPreview = False
NProgs = 0
NDays = 5    'five week days
slotsPerDay = 6 'three hours, 6 half-hour slots
NSlots = NDays * slotsPerDay
startTime = fakeToday + CVDate("7:00 PM") 'time would be variable and set at
activate
20   startTime = DateAdd("d", 2 - Weekday(startTime), startTime) 'set startTime to
Monday(=2)
      'set time slot scale and place the permanent objects
Me.ScaleWidth = NSlots
lblTime(0).Width = 1
shpSlot(0).Width = 1
25   For i = 1 To NDays
      'place and caption day labels
      Load lblDay(i)
      SizeAControl lblDay(i), 0, lblHEIGHT, slotsPerDay * (i - 1), slotsPerDay
      lblDay(i).Caption = DayString(i + 1, "short")
      lblDay(i).Visible = True
30   Next i
      For d = 1 To NDays
          For i = 1 To slotsPerDay
              n = (d - 1) * slotsPerDay + i
              'place time slot dividers
              Load shpSlot(n)
              shpSlot(n).Move n - 1
              shpSlot(n).ZOrder
              shpSlot(n).Visible = True
              'place time labels
              Load lblTime(n)
40   lblTime(n).Move n - 1
              lblTime(n).ZOrder
              t = DateAdd("n", 30 * (i - 1), startTime)
              lblTime(n).Caption = TimeLabel(t)
              'time captions would be set at activate since they could change (when
sameView false)
45   shpSlot(i).FillStyle = 1'transparent
              lblTime(i).BackStyle = 0'transparent
              lblTime(n).Visible = True
          Next i
          'place day separators, but don't show yet
50   If d < NDays Then

```

```

      Load dayLine(d)
      dayLine(d).X1 = d * slotsPerDay
      dayLine(d).X2 = d * slotsPerDay
5     End If
      Next d
      InputData
      Form_Activate
      sameView = True
    End Sub
10

Sub InputData ()
  'part of form_load
  'opens the database and creates allData snapshots

15   Dim DB As database
      Dim RefSnap As snapshot
      Dim i As Integer

      Set DB = OpenDatabase(TVDB)
      'assumes data already sorted by station, start
20

      'get reference date and number of stations
      Set RefSnap = DB.CreateSnapshot("Reference")
      RefSnap.FindFirst "Name = 'Date'"
      refDate = DateValue(RefSnap("Data"))
25      RefSnap.FindFirst "Name = 'NStations'"
      MaxStation = Val(RefSnap("Data"))

      Set allData(0) = DB.CreateSnapshot("Programs")

30      'create snapshots of all programs for each weekday at fixed time
      ' time would be variable and these would have to be created at activate
      TSBegin = DateDiff("n", refDate, startTime) \ 30
      TSEnd = TSBegin + slotsPerDay - 1
      For i = 1 To 5
        allData(i).Filter = Overlap(TSBegin + 48 * (i - 1), TSEnd + 48 * (i - 1))
35      '48 time slots/day
        Set allData(i) = allData(0).CreateSnapshot()
      Next i
      Set allData(0) = Nothing 'won't be needing everything since time is fixed
    End Sub

40   Sub MakeDisplay ()
      'create the visual schedule of programs from the filtered data
      Dim d As Integer 'day
      Dim c As Integer 'counter
      Dim F As snapshot  'convenience
45      Dim hasProgs As Integer 'remember the first day that has programs in it

      'set times showing
      If Not sameView Then
        'would change time labels here
      End If
50

```

```

'place program shapes
hasProgs = 0
c = 0 'init count of shpProgs
5 On Error GoTo ErrorHandler 'if we run out of shpProgs to allocate
For d = 1 To NDays
    currDay = d
    Set F = filterData(d)
    'create a shape control for each TV program in the data
    If Not F.EOF Then
        F.MoveFirst
        Do While Not F.EOF
            Load shpProg(c + 1)
            c = c + 1 'increment only after allocate succeeds
            shpProg(c).BackColor = Color(F(colorField) Mod 9)
            Position shpProg(c), F("Start"), F("Finish"), F("Station")
            shpProg(c).ZOrder
            shpProg(c).Visible = True
            F.MoveNext
        Loop
        F.MoveFirst
        If hasProgs = 0 Then hasProgs = d 'remember the first day with programs
20    in it
        End If
    Next d
MoveOn:
25    On Error GoTo 0 'quit trapping errors internally
    'make day lines visible on top
    For d = 1 To NDays - 1
        dayLine(d).ZOrder
        dayLine(d).Visible = True
    Next d
30
    'initialize stuff
    NProgs = c
    currDay = hasProgs
    shpProg(0).ZOrder
    selector.ZOrder
    35    If currDay > 0 Then
        'set time slot begin and end numbers for current day
        TSBegin = DateDiff("n", refDate, startTime) \ 30 + 48 * (currDay - 1)
        TSEnd = TSBegin + slotsPerDay - 1
        TScurrent = TSBegin
        40    Set F = filterData(currDay)
        Do While TScurrent <= TSEnd
            F.FindFirst Overlap(TScurrent, TScurrent)
            If Not F.NoMatch Then
                DisplayProg
                Exit Do
            End If
            TScurrent = TScurrent + 1
        Loop
        45    Else
            TSBegin = DateDiff("n", refDate, startTime) \ 30
            TSEnd = TSBegin + slotsPerDay - 1
50

```

```

      TScurrent = TSBEGIN
      currDay = 1
End If
shpSlot(TScurrent - TSBEGIN + 1 + (currDay - 1) * slotsPerDay).FillStyle =
C'solid
    lblTime(TScurrent - TSBEGIN + 1 + (currDay - 1) * slotsPerDay).BackStyle =
I'opaque
    Exit Sub

10 ErrorHandler:
    If Err = 342 Then
        'ran out of room to allocate program shapes, quit drawing
        Resume MoveOn
    Else
        Dim msg
        msg = Error & Chr(13) & "Resume or Cancel?"
        msg = InputBox(msg, "Error Correction", "Resume")
        If msg = "" Then Stop
        Resume MoveOn
    End If
20 End Sub

Sub Position (shape As Control, start, finish, station)
'position a program shape for display
    Dim relativeL, relativeW, dayStart
25    Dim edge
    'convert a day/time to position in Nslot scale
    dayStart = startTime + currDay - 1
    relativeL = (start - dayStart) * 48
    relativeW = (finish - dayStart) * 48 - relativeL
    'clip shapes off at day boundaries
30    If relativeL < 0 Then
        relativeW = relativeW + relativeL
        relativeL = 0
    End If
    If relativeW + relativeL > slotsPerDay Then relativeW = slotsPerDay - relativeL
35    'set left and width of shape
    edge = (currDay - 1) * slotsPerDay
    shape.Left = relativeL + edge + sideGap
    shape.Width = relativeW - 2 * sideGap
    'enforce minimum width so program is visible
40    If shape.Width < MINProgWidth Then shape.Width = MINProgWidth
    'set top according to station
    'note: this scheme only works because stations are named 1..n
    rowOffset = ((500 - 2 * lblHEIGHT - shpProg(C).Height) / NStation)
    shape.Top = shpSlot(0).Top + topGAP + (station - 1) * rowOffset
    End Sub
45

```

50

Thus, it will now be understood that there has been disclosed a method and apparatus of finding and selecting a program to view from a large schedule of TV programs. While the invention has been particularly illustrated and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form, details, and applications may be made therein. For example, color coding of the individual items of the reduced representations and of the various entries in the various grid displays could be used to assist the viewer in making rapid program selections. Another example is that it is easily within the capabilities of this art to modify a TV set by integrating the set top box according to the present invention into it. It is accordingly intended that the appended

claims shall cover all such changes in form, details and applications which do not depart from the true spirit and scope of the invention.

5      **Claims**

1. Apparatus for selecting an item from a group thereof in a system having display means and interactive movable pointing means for specifying a location in the display means and making a selection at a specified location, the apparatus comprising:

10      filtration means including subgroup specifiers in the display means and responsive to selection of a subgroup specifier by the pointing means for filtering the group to produce the subgroup specified by the selected subgroup specifier;

15      means for displaying representations of group items belonging to at least a portion of the subgroup in the display means; and

group item selection means for selecting a group item by selecting the representation thereof in the display in response to the pointing means.

2. The apparatus set forth in claim 1 wherein:

20      the pointing means need only be movable from one representation to an adjacent representation.

3. The apparatus set forth in claim 1 wherein:

25      the means for displaying the representations comprises:

first means for displaying the representations in a single dimension; and  
second means for displaying the representations in two dimensions.

4. The apparatus set forth in claim 1 further comprising:

30      means for displaying a reduced representation of the entire subgroup and an indication in the reduced representation of the portion of the group being presently displayed by the display means.

5. The apparatus set forth in claim 4 wherein said reduced representation is two dimensional.

- 35      6. The apparatus set forth in claim 5, wherein said interactive movable pointing means includes a remote control having:

a first pair of buttons to control changes in location in the display in a first direction; and  
a second pair of buttons to control changes in location in the display in a second direction.

- 40      7. The apparatus set forth in claim 4 wherein said reduced representation is a two dimensional representation of a three dimensional representation, the third dimension being location within a logical stack of items having at least one common property.

- 45      8. The apparatus set forth in claim 7 wherein each item of a logical stack have viewing timeslot as one common property.

9. A method comprising the steps of:

50      receiving program schedule data by a set top box via a same information conductor that conducts program information to the set top box;

filtering said program schedule data in RAM within said set top box;

said set top box showing a first interactive display on a TV connected thereto presenting a plurality of choices for filtering said program schedule data to a viewer;

in response to an interactive selection by said viewer, filtering said program schedule data into a first subgroup of program schedule data;

also in response to an interactive selection by said viewer, said set top box showing a second interactive display on said TV having a second plurality of choices for filtering said program schedule data;

in response to a second interactive selection by said viewer, filtering said first subgroup into a second subgroup;

and

also in response to a second interactive selection by said viewer, said set top box showing a third interactive display on said TV having a representation of each program item of said second subgroup.

- 5      10. The method of claim 9, wherein said receiving program schedule data step further comprises the steps of
  - receiving a first portion of said program schedule data via said set top box; and
  - receiving a second portion of said program schedule data at a later non-contiguous time.
- 10     11. The method of claim 9, further comprising the step of:
  - in response to an interactive highlighting of a representation of a program item of said second subgroup, displaying a title thereof.
- 15     12. The method of claim 11, further comprising the step of:
  - in response to an actuation of a select button of a remote control, displaying a preview of said highlighted program.
- 20     13. The method of claim 12, further comprising the step of:
  - in response to a second actuation of said select button of said remote control, switching said set top box to display a TV program corresponding to said highlighted representation.
- 25     14. The method of claim 12, further comprising the step of:
  - in response to a second actuation of said select button of said remote control, storing a command to switch said set top box to display a TV program corresponding to said highlighted representation in when that TV program begins.
- 30     15. A method comprising the steps of:
  - receiving program schedule data for at least 300 individual channels for a time period of at least a week;
  - storing said program schedule data in local memory for rapid sorting and retrieval in a database format;
  - filtering the program schedule data in response to interactive user inputs into a subgroup of the program schedule data;
  - displaying the subgroup of the program schedule data for the user's review; and
  - interactively selecting a program from the subgroup of program schedule data for viewing on a TV screen.
- 35     16. A method for choosing a desired program from a large schedule of programs whose data is stored in a local memory, comprising the steps of:
  - displaying a vertically cascaded group of cards with each card representing a program of a particular time and channel;
  - displaying a selection window located around a subgroup of said group of cards;
  - displaying a two-dimensional grid adjacent to said vertically cascaded group of cards in which said subgroup of the programs represented by said vertically cascaded group of cards are shown in greater detail;
  - displaying a first active area within said selection window highlighting one of said subgroup of programs;
  - displaying a second active area within said two-dimensional grid, said second active area being located around and highlighting greater details of the program highlighted in said first active area;
  - moving said first active area in a vertical direction in response to vertical direction arrows to a viewer's input of a remote control; and
  - selecting a desired program by moving said active area to said desired program and actuating a select button until said set top box makes said selection.
- 40     17. The method according to claim 16, further comprising the steps of
  - after said active area is moved one location outside of said selection window by inputs from said viewer, moving said selection window to a contiguous subgroup to which said active area has moved.
- 45     18. Apparatus for selecting an item from a group thereof in a system having display means and interactive movable pointing means for specifying a location in the display means and making a selection at a specified location, the apparatus comprising:

filtration means including subgroup specifiers in the display means and responsive to selection of a subgroup specifier by the pointing means for filtering the group to produce the subgroup specified by the selected subgroup specifier;

5 means for displaying representations of group items belonging to the subgroup in the display means; group item selection means for selecting a group item by selecting the representation thereof in the display in response to the pointing means; and

means for displaying a reduced representation of the entire subgroup and an indication in the reduced representation of the portion of the group being presently displayed by the display means;

10 said reduced representation displaying means displaying a two dimensional representation of a three dimensional representation, a third dimension being represented as a logical stack of items having at least one common property.

19. The apparatus set forth in claim 8 or 18, wherein said interactive movable pointing means includes a remote control having:

15 a first pair of buttons to control changes in location in the display in a first direction; and  
a second pair of buttons to control changes in location in the display in a second direction; and  
a third pair of buttons to control changes in location within the logical stack.

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FIG. 1

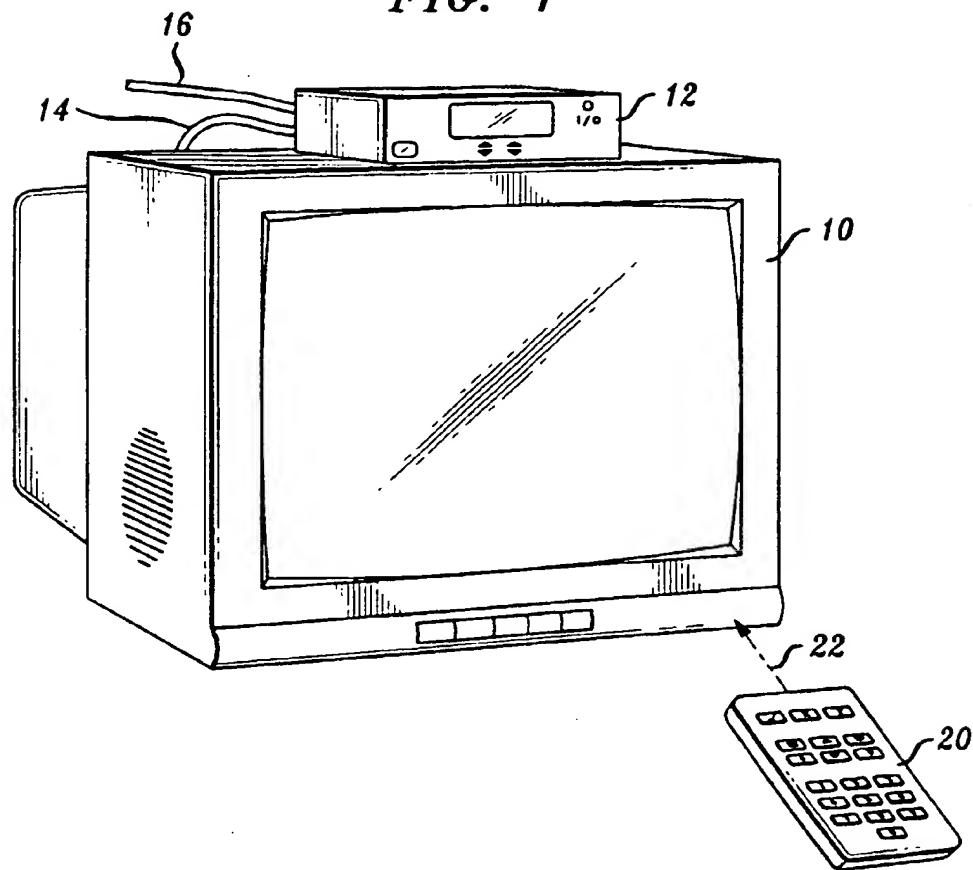


FIG. 2

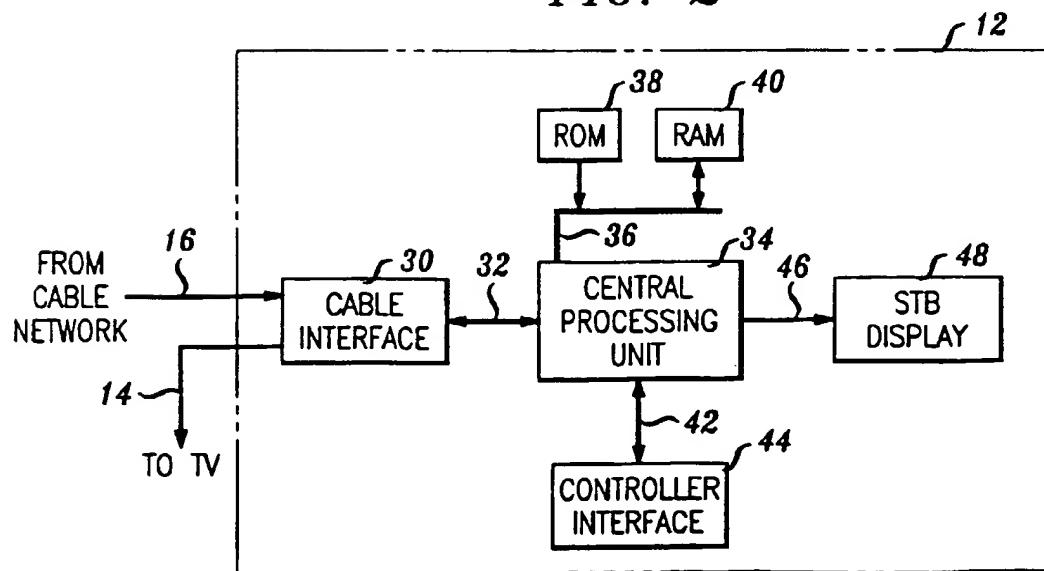


FIG. 3

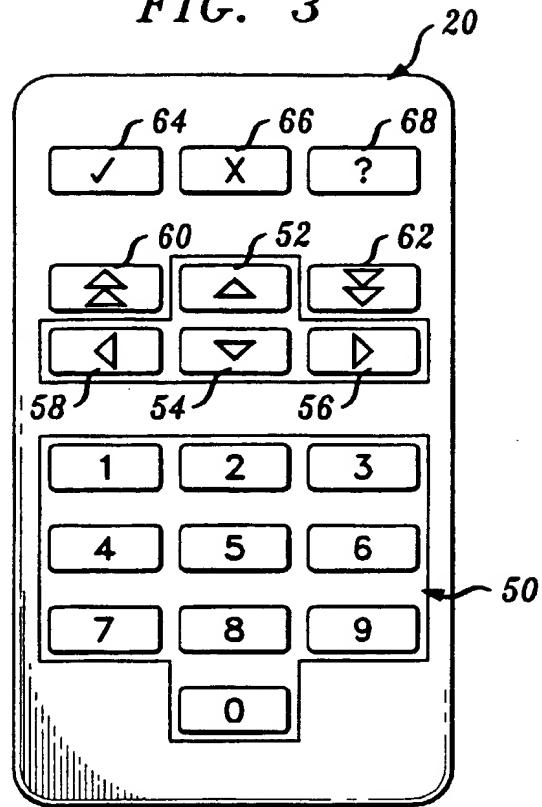


FIG. 4

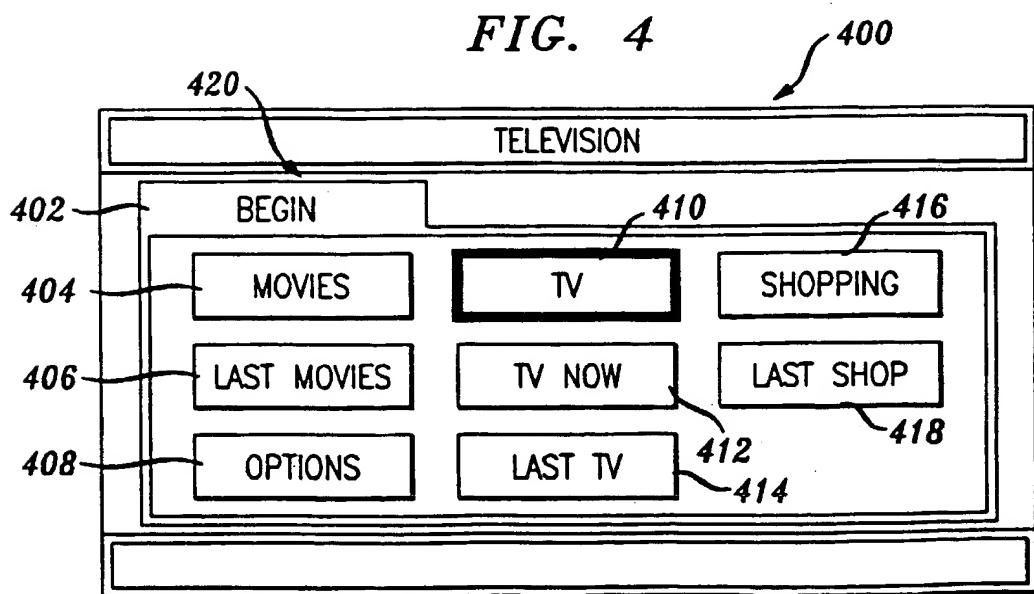


FIG. 5

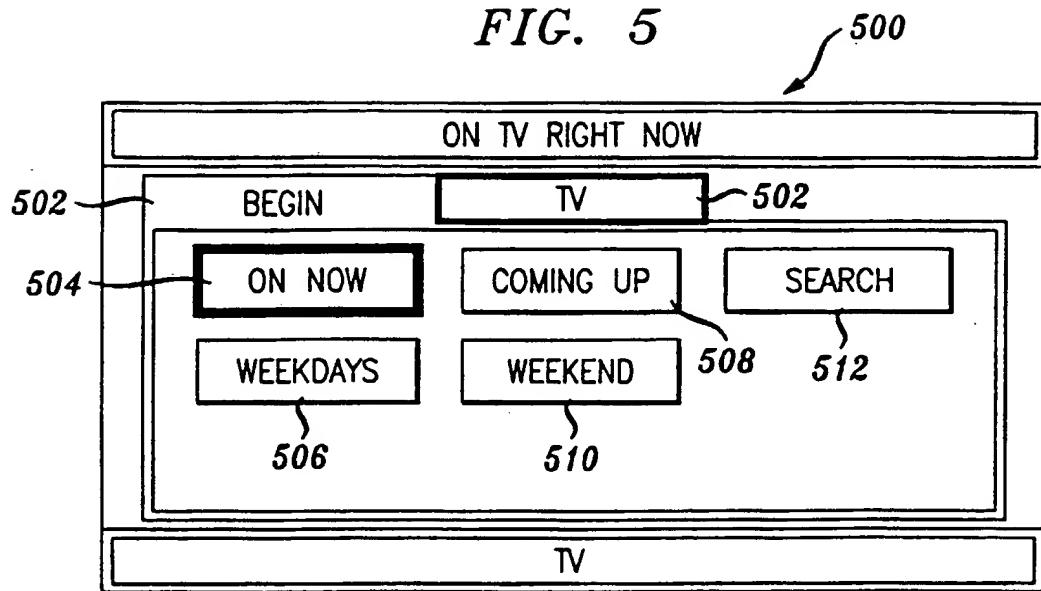


FIG. 6

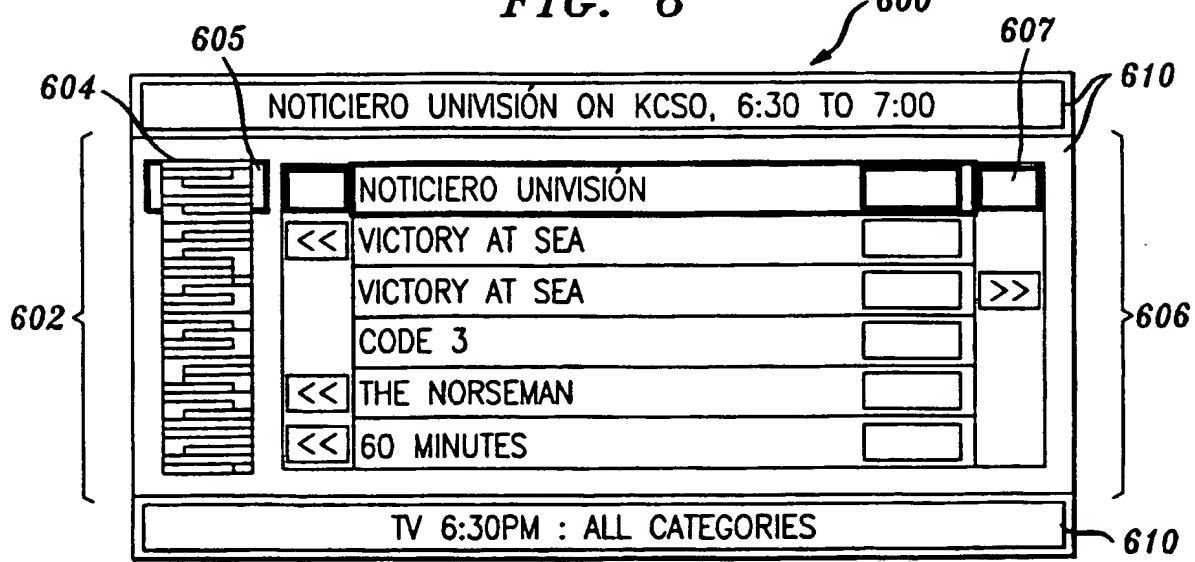


FIG. 7

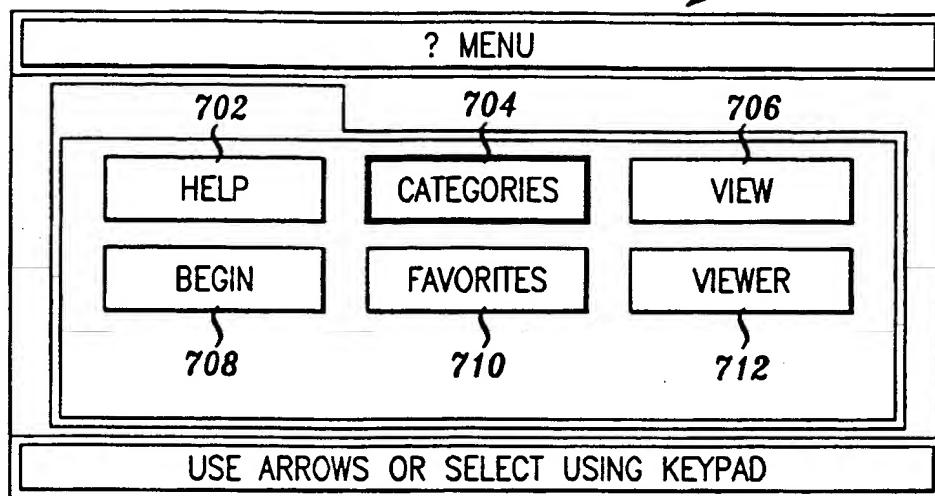


FIG. 8

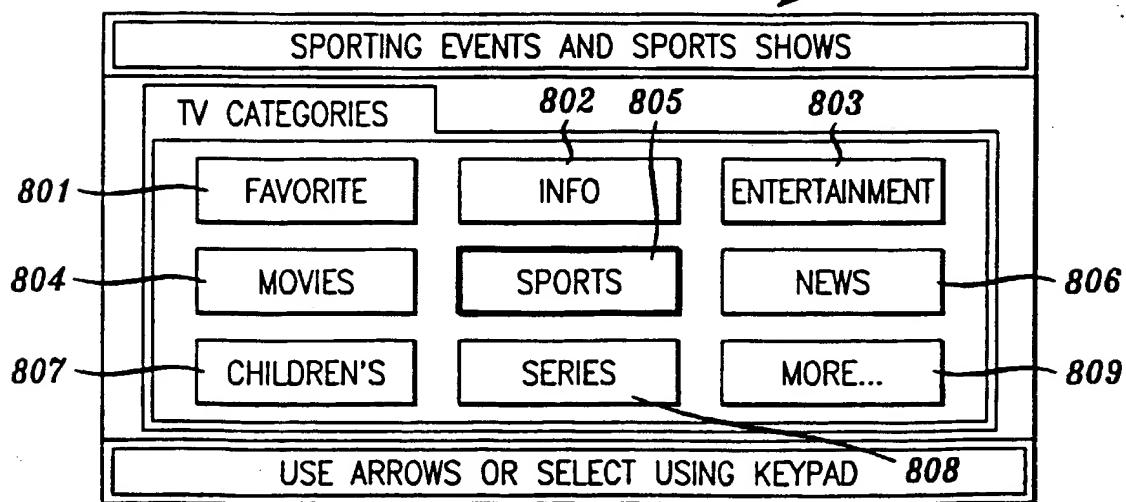


FIG. 9

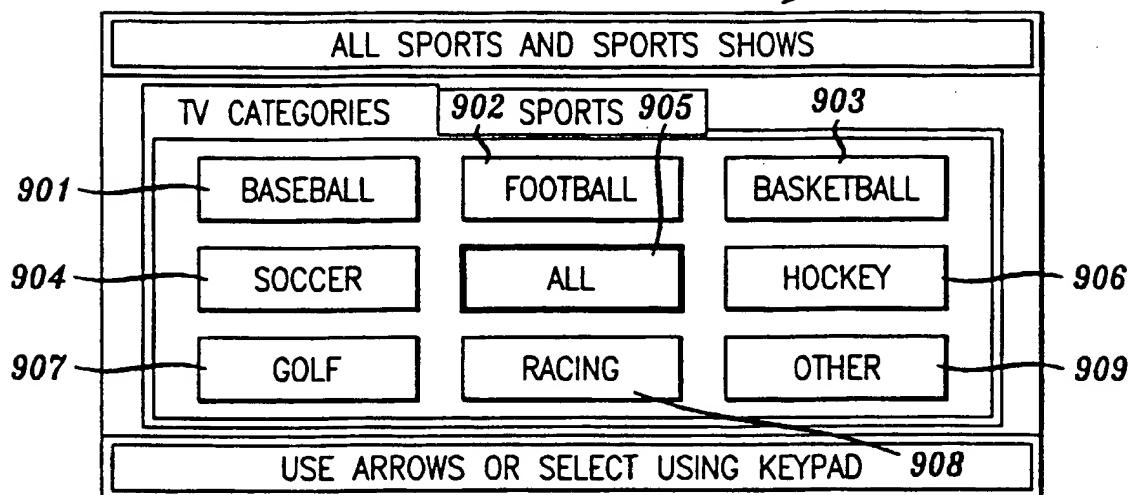
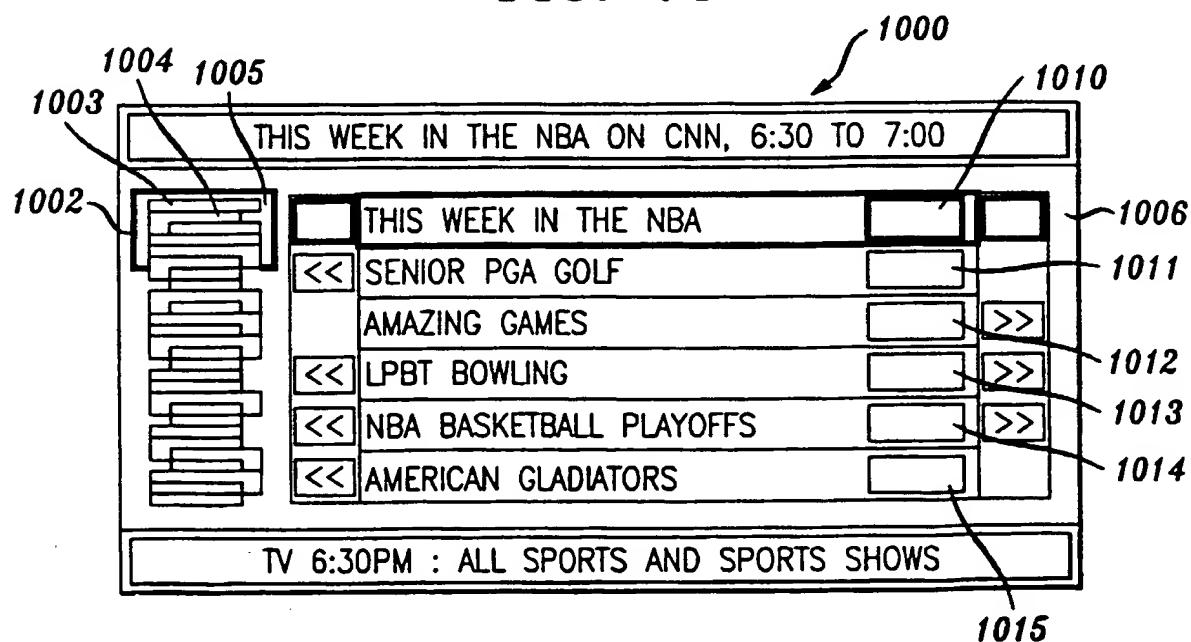
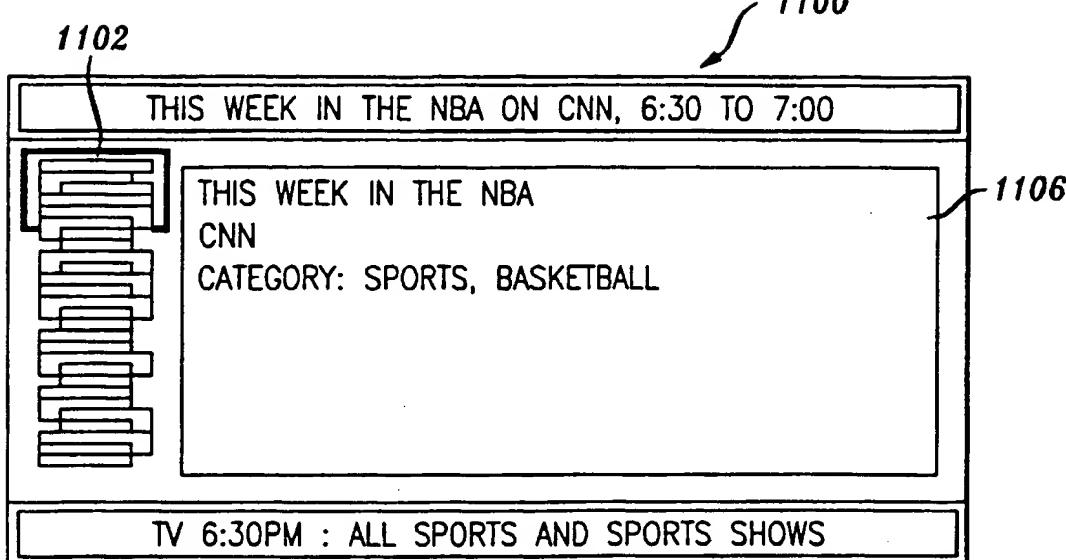


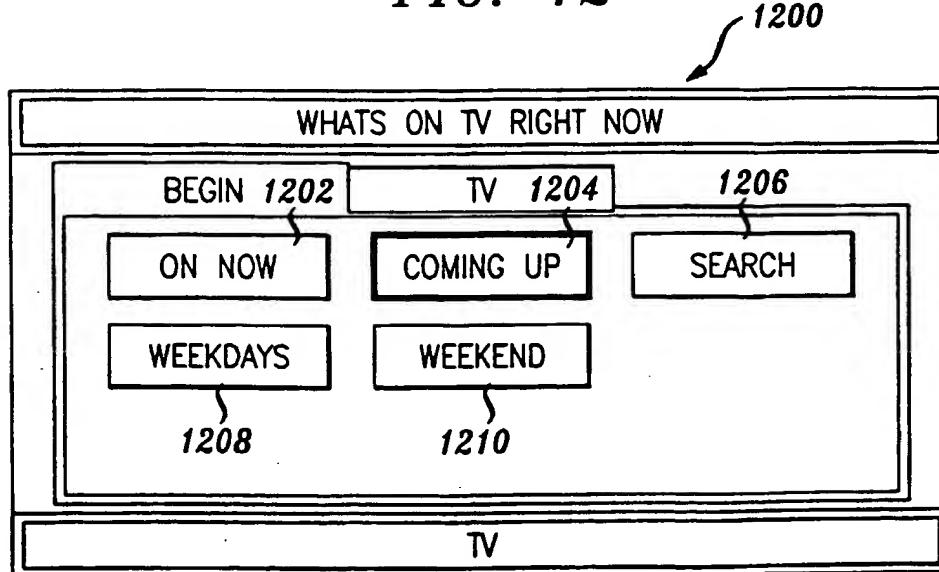
FIG. 10



*FIG. 11*



*FIG. 12*



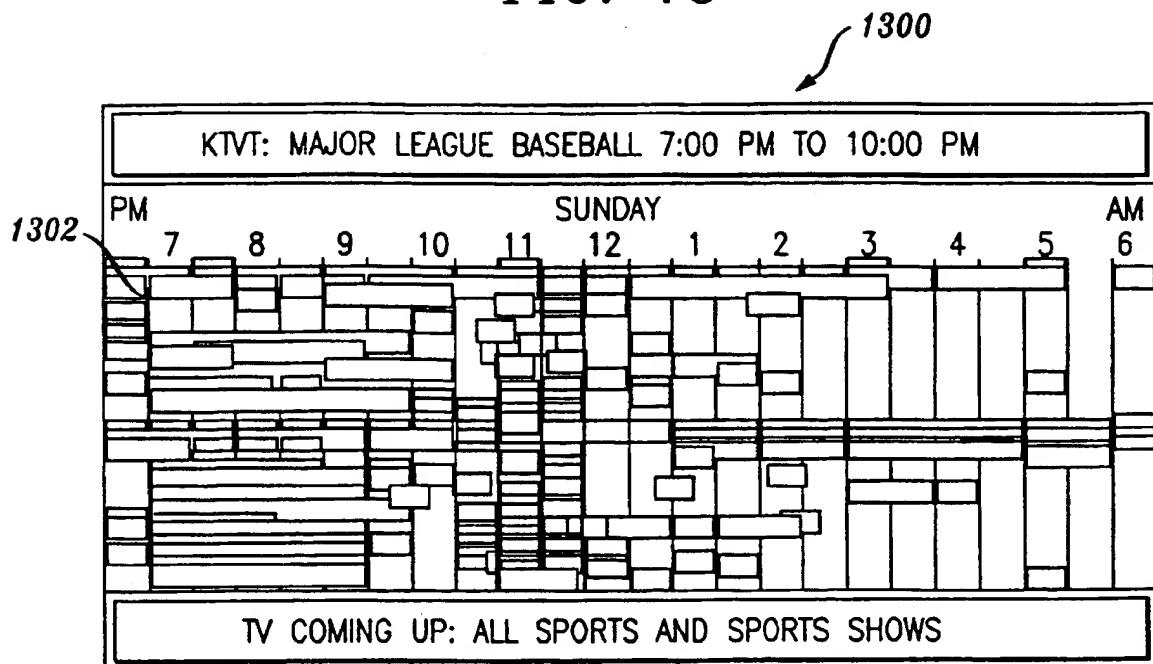
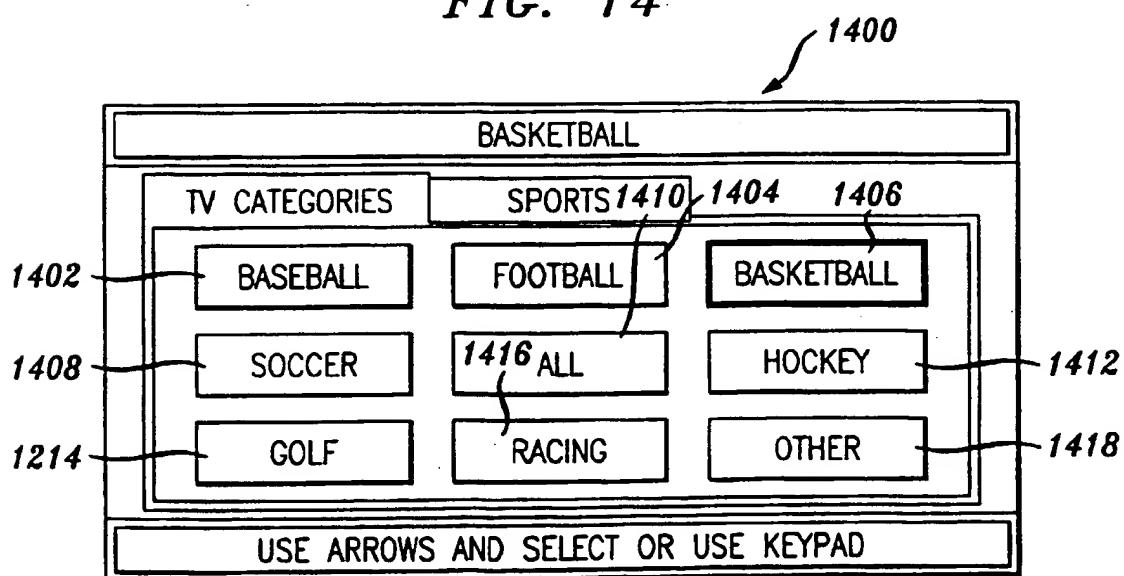
**FIG. 13****FIG. 14**

FIG. 15

- 1500

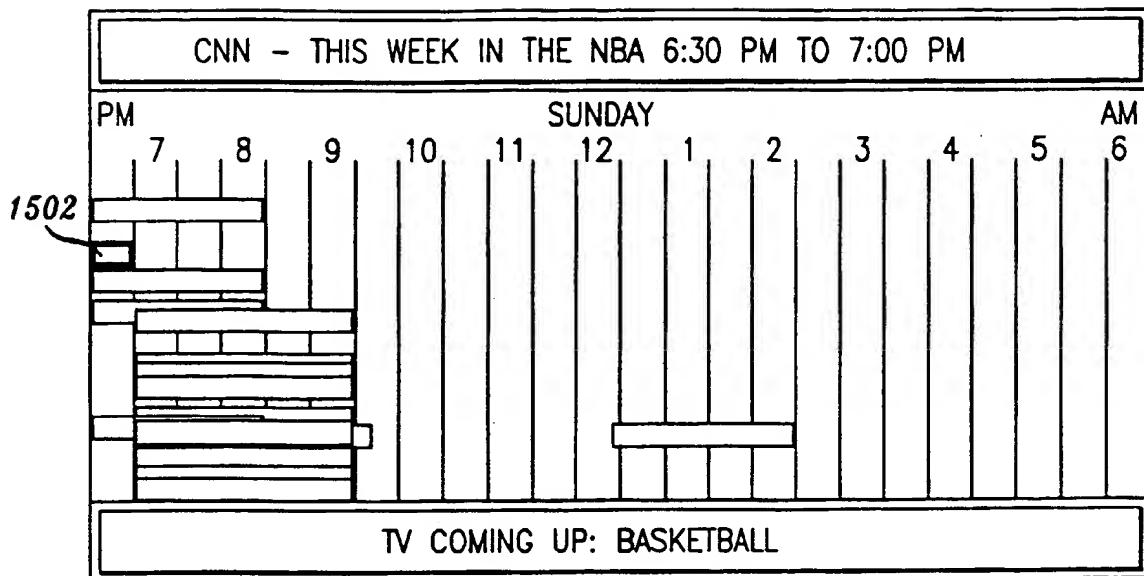


FIG. 16

- 1600

TITLES BEGINNING WITH 'SYMBOL OR NUMBER'		
	SYMBOL OR NUMBER	>>
	A, B, C, D, E, F,	>>
	G, H, I, J, K, L,	>>
	M, N, O, P, Q, R,	>>
	S, T, U, V, W, X,	>>
	Y, Z	>>

FIG. 17

1700

TITLES BEGINNING WITH 'M, N, O, P, Q, R'	
SYMBOL OR NUMBER	>>
A, B, C, D, E, F,	>>
G, H, I, J, K, L,	>>
<input checked="" type="checkbox"/> M, N, O, P, Q, R,	>>
S, T, U, V, W, X,	>>
Y, Z	>>

TV. SEARCH

FIG. 18

1800

TITLES BEGINNING WITH 'M'	
M	>>
N	>>
O	>>
P	>>
Q	>>
R	>>

TV TITLES STARTING WITH M, N, O, P, Q, R

FIG. 19

1900

TITLES BEGINNING WITH 'N'	
N	>>
M	>>
O	>>
P	>>
Q	>>
R	>>

TV TITLES STARTING WITH M, N, O, P, Q, R

FIG. 20

2000

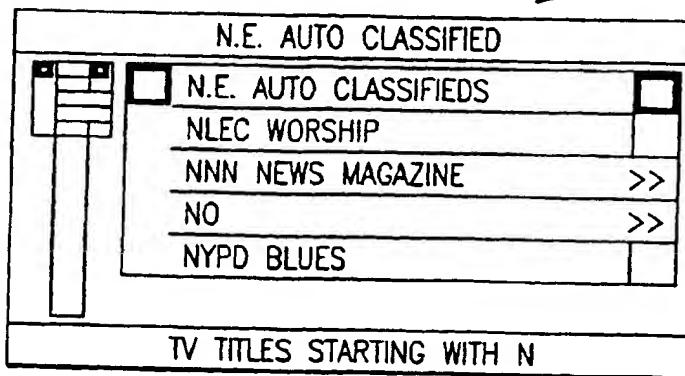


FIG. 21

2100

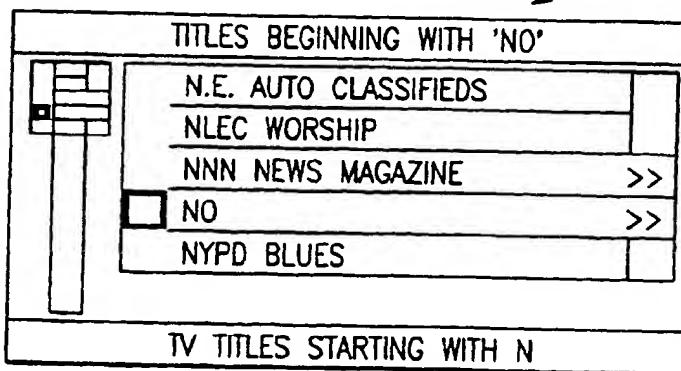
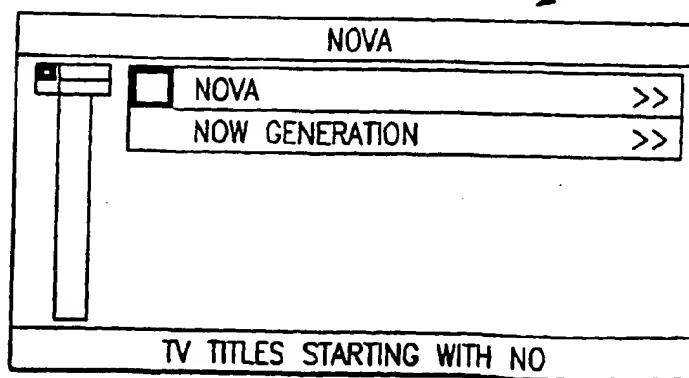


FIG. 22

2200



*FIG. 23*

2300

2304

WLVT: 12:00 AM TO 1:00 AM, NOVA (EPISODE TITLE)																							
2302	AM					NOON				PM													
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10
SUN													*										
MON					*																		*
TUE																		*		*			
WED													*										*
THUR													*										*
FRI																							
SAT																		*					
THIS WEEK: NOVA																							

(19)



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(11)

EP 0 735 749 A3

(12)

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(54) **Method and apparatus for finding and selecting a desired data item from a large schedule of data items using a TV set and a controller similar to a TV-remote-control**

(57) An apparatus and method for presenting a viewer with an overall representation of the present number of entertainment programs available for selection given one week of program schedule data for 300 or more channels and one or more filtering criteria to limit the number of items represented in the overall representation. Sequentially applied filters will filter the group of program schedule data items that has at least 100,000 half hour time slots offered by 300 channels each week into a smaller subgroup where individual

consideration of each item of the subgroup can be made in a reasonable time. A set top box drives the display of overall representations or results of filtering criteria on a commercial TV set. Once a reasonable sized subgroup is obtained, other displays provide specific information of the program offerings of the subgroup. Selection of the filtering criteria and selection from within a subgroup is interactively made by a viewer through the use of a controller that looks and operates very much like a TV remote control. This makes the interaction familiar, easy and predictable.

EP 0 735 749 A3



European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number  
EP 96 30 1902

DOCUMENTS CONSIDERED TO BE RELEVANT									
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)						
X	EP 0 560 593 A (SONY) * column 3, line 35 - column 5, line 45 * * column 21, line 23 - column 22, line 18; figure 19 *	1-6,18 16,17	H04N5/445						
X	BRUGLIERA V: "DIGITAL ON-SCREEN DISPLAY A NEW TECHNOLOGY FOR THE CONSUMER INTERFACE" 11 June 1993, CABLE TV SESSIONS, MONTREUX, JUNE 10 - 15, 1993, NR. SYMP. 18, PAGE(S) 571 - 586, POSTES;TELEPHONES ET TELEGRAPHES SUISSES XP000379382	1-3,9, 11-15							
A	* the whole document *	18							
X	WO 94 14282 A (DISCOVERY COMMUNICATIONS) * page 3, line 4 - line 19 * * page 4, line 8 - page 5, line 2 * * page 5, line 30 - page 7, line 22 * * page 12, line 7 - line 21 * * page 13, line 14 - line 32 * * page 14, line 12 - page 15, line 2 * * page 23, line 14 - page 24, line 28 * * page 26, line 17 - line 28 * * page 27, line 5 - line 31 * * page 29, line 31 - page 30, line 8 * * page 34, line 28 - page 35, line 5 * * page 51, line 10 - page 52, line 30 * * page 56, line 7 - page 57, line 22 * * page 72, line 15 - page 77, line 25 * * figures 9A,9B,13-19 *	1,2,9-15	TECHNICAL FIELDS SEARCHED (Int.Cl.6)						
A	WO 93 22877 A (ICTV) * page 33, line 4 - page 34, line 34 * * figures 8,33,36-41 *	1,2,9-15	H04N						
		-/-							
<p>The present search report has been drawn up for all claims</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Place of search</td> <td style="width: 33%;">Date of completion of the search</td> <td style="width: 34%;">Examiner</td> </tr> <tr> <td>THE HAGUE</td> <td>2 July 1997</td> <td>Berwitz, P</td> </tr> </table>				Place of search	Date of completion of the search	Examiner	THE HAGUE	2 July 1997	Berwitz, P
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THE HAGUE	2 July 1997	Berwitz, P							
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document							
<small>EPO FORM 1501 01/82 (PATENT)</small>									



European Patent  
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## EUROPEAN SEARCH REPORT

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EP 96 30 1902

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
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P,A	WO 95 26608 A (LOEWE OPTA) * page 4, line 16 - page 6, line 21 * * page 7, line 4 - line 12 * * page 8, line 4 - page 10, line 27 * * page 11, line 15 - line 31 * * page 13, line 1 - line 12 * ---	1,2,9, 11-15	
E	EP 0 721 253 A (SONY) * column 1, line 8 - line 19 * * column 3, line 2 - line 15 * * column 19, line 17 - line 25 * * column 19, line 51 - column 20, line 13; figures 2,23-26 * -----	1,2,9, 11-13	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	2 July 1997	Berwitz, P	
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			
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